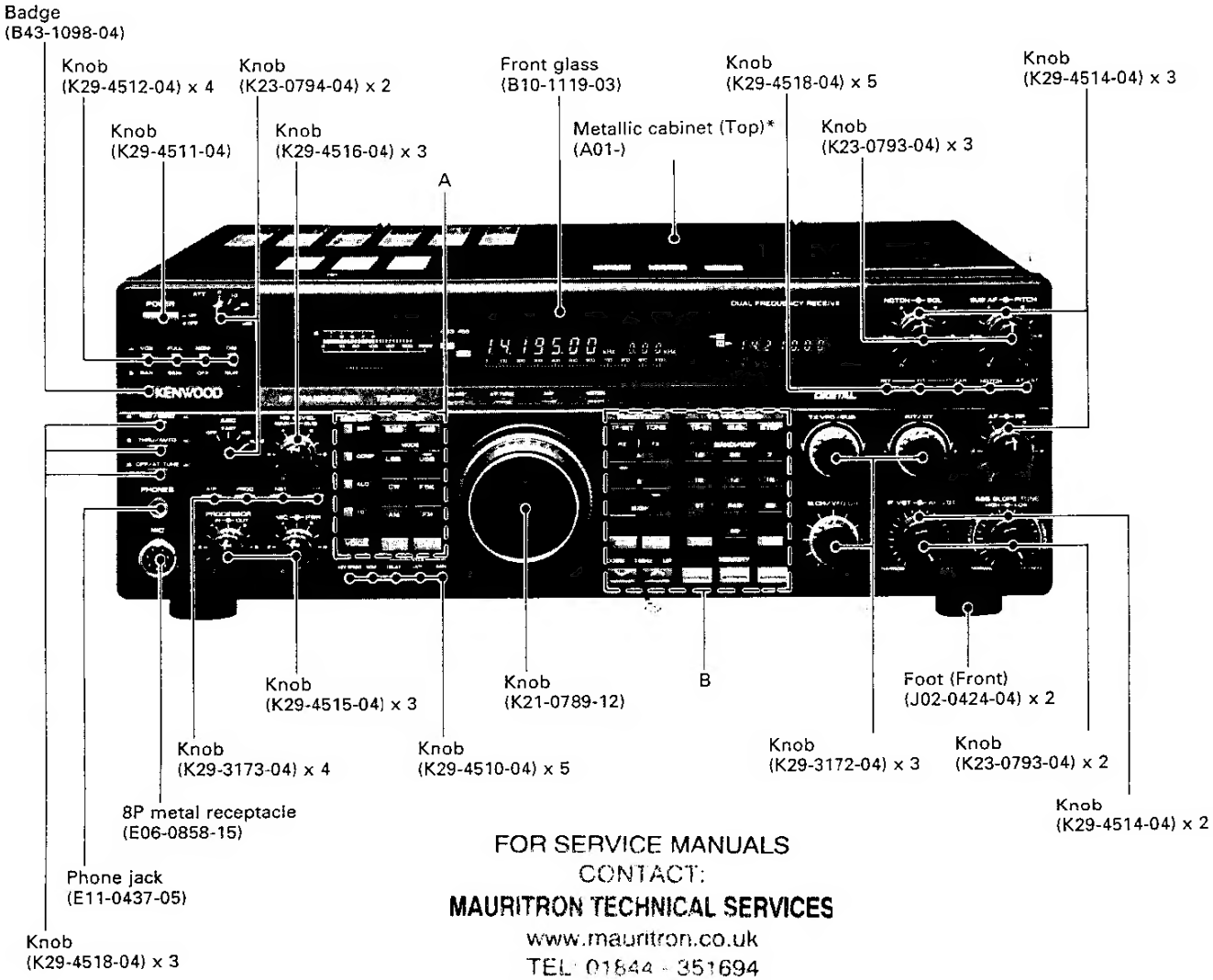
HF TRANSCEIVER

TS-950S/SD

SERVICE MANUAL

KENWOOD

B51-8018-00 (O) 1336



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A

Knob (K29-3173-04)	Knob (K29-3192-03)	Knob (K29-3193-03)
Knob (K29-3173-04)	Knob (K29-3194-03)	Knob (K29-3195-03)
Knob (K29-3173-04)	Knob (K29-3196-03)	Knob (K29-3197-03)
Knob (K29-3173-04)	Knob (K29-3198-03)	Knob (K29-3199-03)
Knob (K29-3191-03)	Knob (K29-4501-03)	Knob (K29-4504-03)

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Knob (K29-3189-03)	Knob (K29-3190-03)	Knob (K29-3186-03)	Knob (K29-3187-03)	Knob (K29-3188-03)
Knob (K29-3200-03)	Knob (K29-3200-03)	Knob (K29-3175-03)	Knob (K29-3176-03)	Knob (K29-3177-03)
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Knob (K29-3200-03)	Knob (K29-3200-03)	Knob (K29-3181-03)	Knob (K29-3182-03)	knob (K29-3183-03)
Knob (K29-4502-03)	Knob (K29-4503-03)	Knob (K29-3184-03)	Knob (K29-3174-03)	Knob (K29-3185-03)
Knob (K29-4508-04)	Knob (K29-4509-04)	Knob (K29-4505-04)	Knob (K29-4506-04)	Knob (K29-4507-04)

*** Refer to parts list on page 96.**

CONTENTS

CIRCUIT DESCRIPTION

Frequency Configuration

The TS-950 utilizes quadruple conversion for SSB, CW, AM, and FSK modes and triple conversion for FM mode. The transmitter utilizes double conversion in CW and FM modes and triple conversion in SSB, AM, and FSK modes.

Receiver and transmitter audio is routed through the Digital Signal Processing Unit when it is installed. This unit supplies either a simple 455 kHz carrier (FM Mode) or a modulated 455 kHz IF frequency in all other modes. Figure 1 shows the transmit and receive frequency configuration .

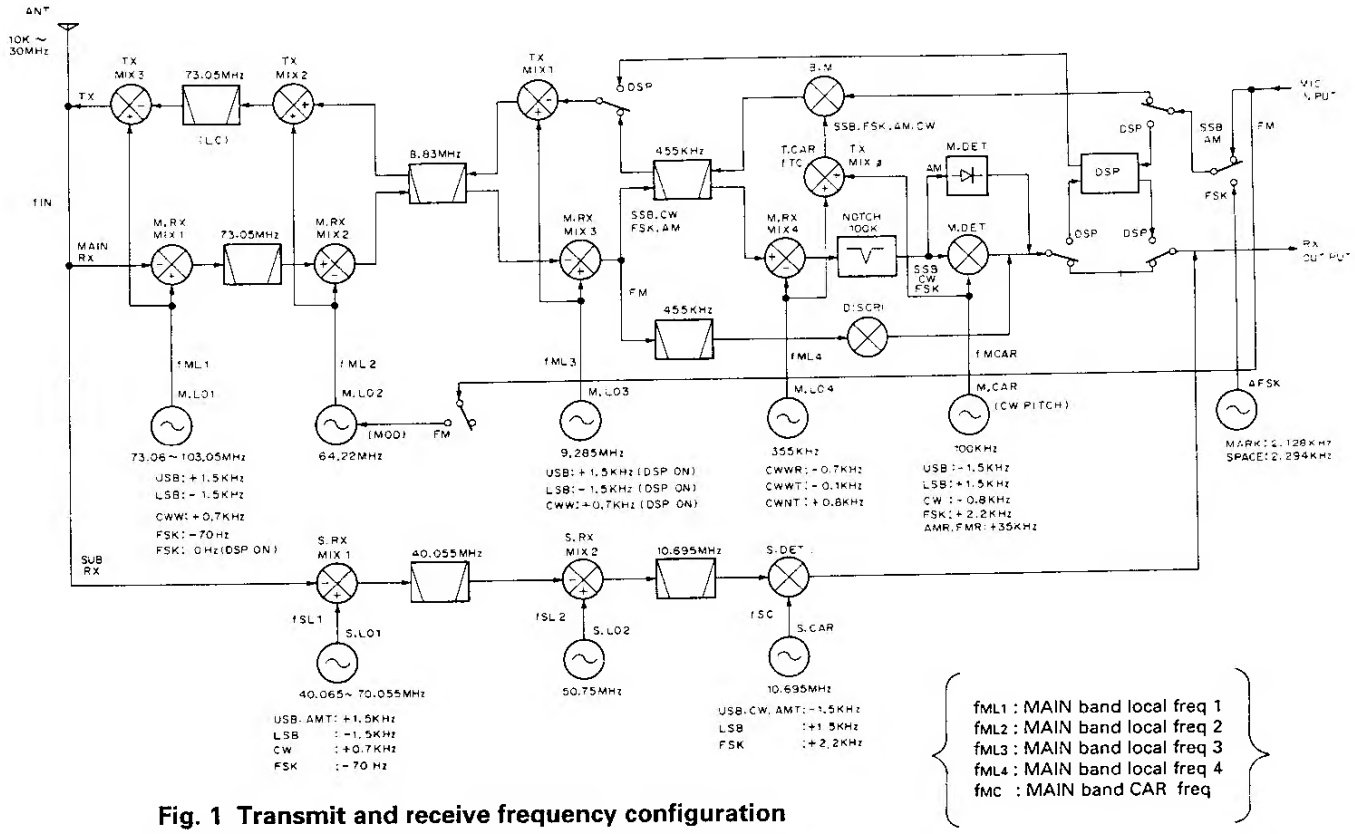


Fig. 1 Transmit and receive frequency configuration

- **Main frequency configuration**

The equation shown below holds true when the receiver is zero beat.

$$f_{IN} = f_{ML1} - f_{ML2} - f_{ML3} + f_{ML4} + f_{MC} \quad \ldots\ldots (1)$$

Since all these frequencies are generated by the PLL circuit (as shown in Figure 2), the receiver frequency is determined only by the reference f_{STD} and the PLL divide ratio. Therefore, the stability/accuracy of the reference frequency determines the overall frequency stability/accuracy of this transceiver. The stability/accuracy of the reference crystal oscillator used in the TS-950S is 10 PPM (–10 to +50°C). The frequency stability is 0.5 PPM (–10 to +50°C) for the TS-950SD or when the optional temperature compensated crystal oscillator (TCXO), SO-1 or SO-2, is used with the TS-950S. When an external reference is used, the stability/accuracy of the transceiver will be determined by that external standard.

The TS-950 local oscillator and the CAR PLL circuits are independent of each other. However, they can be operated in a manner that is similar to a "cancel loop" configuration by changing the CAR and local oscillator PLL data simultaneously with the microprocessor. This function allows changes in the f_{MC} and f_{ML1} lines when the mode changes, and also allows the band width of the VBT and slope tune to be varied (f_{ML4} and f_{ML3}, f_{ML3} and f_{ML1}).

When used as a transmitter , the frequency is determined by the reference frequency (f_{STD}) and divide ratio. The display frequencies in the various modes are listed in Table 1. (In the FSK mode, the TS-950, unlike the TS-940, displays the mark transmitter frequency.)

The pitch of the incoming receive signal in the CW mode can be adjusted to suit the operators preference without changing the center frequency of the transceiver variable CW pitch system. Changes in the receiving pitch are directly related to the transmitter CW sidetone. This results in a easy zero beat procedure for the CW operator.

CIRCUIT DESCRIPTION

Mode	Display frequency
USB, LSB	Carrier point frequency
CW	Transmit carrier frequency
FSK	Mark transmitter frequency
AM, FM	IF filter center frequency

Table 1 Display frequency in each mode

FSK transmission is normally performed in the LSB mode. The audio signal (mark = 2.128 kHz, space = 2.294 kHz) is obtained by dividing the reference frequency fSTD. The IF signal is shifted for both transmission and reception so that the mark/space signal passes through the center of the IF filter. The fML1 signal is shifted in transmit in order to display the mark frequency on the display.

FM transmission is performed directly on the fML2 signal by using the microphone audio to modulate the VCO0 signal.

For reception in AM and FM modes, the fMC line is shifted by the VCO9 signal so that no carrier enters the IF.

When the DSP is connected, the fMC and fML4 lines are used as output signals from the DSP unit in the transmit mode. Mode changes are performed by the fML3 line. The FSK mode differs from the AFSK mode since the signal supplied to the IF unit is obtained from the DSP directly, therefore changes in the signal that would normally be expected due to a change in the mode are not performed. Since the reference frequency applied to the DSP is supplied from the reference oscillator (fSTD) for the main unit, no changes to the operating frequency will occur when the DSP is connected.

- **Sub-Receiver frequency configuration**

The equation shown below holds true when the receiver is zero beat.

$$f_{IN} = f_{SL1} - f_{SL2} + f_{SC} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

The crystal oscillator signal (fSL2) is applied to the PLL circuit in order to generate the fSL1 signal. The sub-receiver frequency, like the main receiver frequency stability/accuracy, is determined only by the reference fSTD and the PLL divide ratio. Likewise, when the unit is used for transmission in (the sub receiver is turned off in the AM and FM modes), the frequency stability/accuracy is determined by the reference fSTD and the PLL divide ratio. The display frequencies in the various modes are the same as those described for the main frequency.

Since the sub-receiver works as a transmit frequency monitor, the IF frequency is shifted to that of the main display frequency in the transmit mode. In the AM and FM modes, the IF frequency equals the main IF frequency.

PLL Circuit

The TS-950 PLL circuit consists of a several loops (MLO1, SLO1) that cover a frequency range of 10 kHz to 30 MHz, in 10-Hz steps; a 20 MHz reference oscillator ; and a PLL loop that is used to generate other local oscillator frequencies (MLO2 to MLO4) and CAR (MCAR, SCAR) signals. Figure 2 shows the PLL system frequency configuration. Division ratio data for each PLL loop is provided by a microprocessor. Each loop is a single crystal frequency control system: where the phase is compared with a unique reference frequency (fSTD).

Figure 3 is a PLL block diagram.

- **Reference oscillator circuit**

The reference frequency (fSTD) used for frequency control is generated by the 20-MHz crystal oscillator X1 and Q13 (2SC2714). Two outputs are provided, one is used as the reference for the PLL unit, and the other is divided in half by IC14 (M74LS90P) to produce a 10-MHz signal. This 10 MHz signal is used as the PLL reference signal (fREF) for the CAR unit, and is applied to the AF and DSP units as the PLL reference signal (fREF). The 10-MHz signal is also divided by five in IC14, and then divided in half by IC15 (TC4013BP) to generate a 1-MHz signal.

The reference signal oscillator circuit can be used as VCXO (Voltage Controlled Crystal Oscillator) by applying an external reference signal. The 1-MHz signal is divided by 100 in IC13 (MC14568BCP) to generate a 10 kHz comparison frequency. The 10-kHz (1 Vp-p) input from the EXT STD passes through amplifier Q12 (2SC2712) and is applied to IC13 where it is then used as the PLL reference signal. It is then compared in the phase comparator in order to lock the reference frequency (fSTD) of OSC1. The internal and external reference frequencies can be controlled by S1. OSC1 can be replaced with the optional SO-1 or SO-2 TCXO. These are controlled by switch S2.

The 20-MHz signal applied to the PLL unit is divided in half by IC9 (SN74LS73AN) to produce a 10-MHz signal. This signal is used as the PLL reference signal (fREF) for the PLL unit and is doubled by Q4 (2SC2714) to produce the 40-MHz reference signal (fREF).

- **Main LO1 (PLL unit/AF unit)**

PLL3, which is downstream from LO1, generates the 58 to 56MHz VCO3 signal. The 10-MHz reference signal (fREF) is applied to pin 5 of IC2 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO3 is applied to pin 11 of IC2, and is divided by a value determined by N3 , and is then compared with the 2-kHz signal in the phase comparator. The frequency of VCO3 is locked

in 2-kHz steps. Division ratio data (N3) is provided by the digital unit as data (29000 to 28001) which corresponds to 0.00 to 9.99 kHz. When the RIT and XIT are used, the division ratio changes so that the frequency of oscillator VCO3 is shifted according to the setting of the RIT and XIT controls.

The output from PLL3 is divided by 20 in IC3 (M54459L), and is applied to pin 2 of IC4 (SN16913P) of MIX4. MIX4 combines the signal with the 10-MHz signal. The resulting signal passes through the bandpass filter to obtain a signal of 12.9 to 12.8 MHz. It is then applied to pin 2 of IC5 (SN16913P) of MIX3.

PLL2 which is in the center of LO1: generates the 49.5 to 44.5 MHz VCO2 signal. The 10-MHz reference oscillator frequency (fREF) is applied to pin 5 of IC6 (CX7925B), and is divided by 100 internally to produce a 100-kHz comparison frequency. The output VCO2 is applied to pin 5 of IC5 of MIX3, where it is mixed with the signal generated by PLL3. The resulting signal passes through the bandpass filter to obtain a signal of 36.6 to 31.7 MHz. This signal is then applied to amplifier Q3 (2SC2714), and then to pin 11 of IC6. This signal is divided by a value determined by N2, and compared with the 100-kHz signal by the phase comparator. The output frequency of MIX3 is locked in 100-kHz steps. Divide ratio N2 is provided by the digital unit as data (366 to 317) which corresponds to 0.00 to 0.49 MHz and 0.50 to 0.99 MHz.

The output from PLL2 is divided by 10 in IC7 (MB467), and is applied to pin 2 of IC8 (SN16913P) of MIX2. MIX2 combines the signal with the 40-MHz signal. The resulting signal passes through the bandpass filter to generate a signal in the range of 35.05 to 35.55 MHz. This signal is applied to buffer amplifier Q5 (2SC2714), and is then routed to the AF unit.

PLL1, which is upstream of LO1: generates the 73.06 to 103.05 MHz VCO1 signal. It consists of four VCOs, Q1 thru Q4 (2SK210x4). The 10-MHz reference frequency (fREF) is applied to pin 5 of IC11 (CXD1225M), and is divided by 20 internally to produce a 500-kHz comparison frequency. The output from VCO1 is amplified by Q33 (2SC2714), and passes through the bandpass filter. One of the output signals is passed through buffer amplifier Q37 (2SC2996) and directed to the RF unit. The other output is applied to pin 5 of IC12 (SN76514N) of MIX1. The signal is then mixed with the signal generated by PLL2 and PLL3. The resulting signal passes through the bandpass filter to produce a signal in the range of 38 to 68 MHz. It then passes through buffer amplifiers Q34 and Q35 (2SC2714x2) and is applied to pin 11 of IC11. This signal is divided by a value that is determined by N1 internally, and compared with the 500-kHz signal by the phase comparator. The output frequency from MIX1 is locked in 500-kHz steps. Divide ratio N1 is provided by the digital unit as data (76 to 136) which corresponds to 10 kHz to 30 MHz. One of the four VCO1 signals is selected according to the VCO change data supplied by the digital unit.

The final output frequency of the main LO1 signal is 73.06 to 103.05 MHz in 10-Hz steps, and depends on the divide ratio data supplied by N1 to N3. This signal is supplied to the RF unit.

- **Main LO2 (AF unit)**

In PLL0, Q1 (2SK508NV) of VCO0 is used to generate a signal of 64.22 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC13 (CXD1225M), and is divided by 500 (2000 in FM mode) internally to produce a 20-kHz (5-kHz in FM mode) comparison frequency. The output from VCO0 is applied to pin 11 of IC13, and is divided by 3211 (12844 in FM mode) internally. It is then compared with the 20-kHz (5-kHz in FM mode) reference signal by the phase comparator to lock the VCO0 frequency. Divide ratio data is supplied by the digital unit.

The output from PLL0 passes through buffer amplifier Q39 (2SC2714) and a low-pass filter and is applied to the IF unit as the main LO2 signal.

- **Main LO3 (CAR unit)**

In PLL6, VCO6 is used to generate a signal of approximately 71.5 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC3 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO6 is applied to pin 11 of IC3, and is divided by a value determined by N6 internally, and compared to the 2-kHz reference signal by the phase comparator in order to lock the VCO6 frequency. Divide ratio data N6 is provided by the digital unit. The bandwidth is changed and the carrier point is fine tuned by simultaneously changing the division ratios ($\Delta N6 = \Delta 2N3$) of PLL6 and PLL3 via microprocessor control.

The output from PLL6 is divided by 100 internally in IC4 (M54459L) and applied to pin 2 of IC5 (SN16913P) of MIX7. In MIX7, it is combined with the 10-MHz reference signal. The resulting signal passes through the ceramic filter CF1 to obtain a signal of 9.285 MHz. The signal is further amplified by Q3 (2SC2714), and then applied to the IF unit as the main LO3 signal.

- **Main LO4 (CAR unit)**

In PLL5, VCO5 generates a signal of approximately 35.5 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC1 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO5 is applied to pin 11 of IC1, divided by a valued determined by N5 internally, and compared with the 2-kHz reference signal by the phase comparator to lock the VCO6 frequency. Divide-sion ratio data N5 is provided by the digital unit. The

bandwidth is changed and the carrier point is fine tuned by simultaneously changing the division ratios (ΔN5 = −ΔN6) of PLL5 and PLL6 and (ΔN5 = Δ2N3) of PLL5 and PLL3 via microprocessor control. The division ratios are shifted in CW mode as well.

The output from PLL5 is divided by 100 in IC2 (M54459L) to generate a 355-kHz signal. This signal passes through buffer amplifier Q1 (2SC2712), and is applied to the signaling unit as the main LO4 signal.

- **Sub LO1 (PLL unit)**

In PLL8, downstream from LO1, VCO8 generates a signal from 109 to 107 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC10 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO8 is applied to pin 11 of IC10, divided by a value determined by N8 internally, and compared with the 2-kHz signal by the phase comparator locking the VCO8 frequency in 2-kHz steps. Dividesion ratio data N3 is transmitted from the digital unit as data (54500 to 53501) which corresponds to 0.00 to 9.99 kHz. Since the sub receiver section functions as a monitor circuit in the transmit mode, the division ratio is changed so that the VCO8 oscillator frequency is shifted when XIT is used.

The output from PLL8 is divided by 20 in IC11 (M54459L), and is applied to pin 2 of IC12 (SN16913P) of MIX12. MIX12 combines the signal with the 20-MHz reference oscillator signal. The resulting signal passes through a bandpass filter to obtain a signal of 25.45 to 25.35 MHz. This signal is divided by 10 in IC13 (MB467) and is applied to pin 2 of IC14 (SN16913P) of MIX11. MIX11 mixes the signal with the 10-MHz reference signal. The resulting signal passes through a bandpass filter to obtain a signal of 12.545 to 12.535 MHz. This signal is applied to pin 2 of IC15 (SN16913P) of MIX10. MIX10 mixes the signal with the 50.75-MHz signal from the sub LO2. The resulting signal passes through a bandpass filter to obtain a signal of 38.205 to 38.215 MHz. This signal is applied to pin 2 of IC16 (SN16913P) of MIX9.

In PLL7, which is upstream from LO1, VCO7 generates a signal of from 40.065 to 70.055 MHz. It consists of four VCOs, Q1 thru Q4 (2SK210x4). The 10-MHz reference frequency (fREF) is applied to pin 5 of IC17 (CX7925B), and is divided by 1000 internally to produce a 10-kHz comparison frequency. The output from VCO7 is amplified by Q13 (2SC2714), and passes through a bandpass filter. One of the outputs from this filter is applied to buffer amplifier Q14 (2SC2996) and is directed to the RF unit. The other output is applied to pin 5 of IC16 of MIX9. Here the signal is mixed with the signal generated by PLL8 and LO2 OSC2. The resulting signal passes through a low-pass filter to produce a signal of 1.86 to 31.85 MHz. It then passes through buffer amplifiers Q11 and Q12 (2SC2712x2) and is applied to pin 13 of IC17. This signal is divided by a value determined by N7 internally, and is compared with the 10-kHz reference signal by the phase comparator to lock the MIX9 output frequency in 10-kHz steps. Divide ratio data N7 is provided by the digital unit as data (186 to 3185) corresponding to 10 kHz to 30 MHz. The VCO change data of the four VCO7 VCO's is the same as that of VCO1. The A.LPF uses operational amplifier IC18 (NJM4558SD) and switches the loop constants A to D of VCO7.

The final output frequency of the sub LO1 signal is 40.065 to 70.005 MHz in 10-Hz steps, and depends on the divide ratios N7 and N8, and is applied to the RF unit.

- **Sub LO2 (PLL unit)**

The LO2 local oscillator signals are generated by the 50.75-MHz crystal oscillator (X1) and Q15 (2SC2714). One local oscillator signal is sent to the sub LO1 PLL loop and is applied to pin 5 of IC15 of MIX10. The other local oscillator signal passes through buffer amplifier Q17 (2SC2714) and a low-pass filter, and is directed to the IF unit as the sub LO2 signal. Local oscillator signals generated by the crystal oscillator circuit are applied to the PLL loop to cancel drift.

- **Main and sub CAR (CAR unit)**

In PLL4, VCO4 generates a signal of approximately 69.5 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC6 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO4 is applied to pin 11 of IC6, a divided by a valued determined by N4 internally, and compared with the 2 kHz signal with by phase comparator locking VCO4. Divide ratio data N4 is provided by the digital unit. The mode of operation is changed and the carrier point is fine tuned by simultaneously changing division ratios (ΔN4 – Δ2N3) of PLL4 and PLL3 and division ratios (ΔN4 = Δ2N8) of PLL4 and PLL8 with the microprocessor. The division ratios are also shifted when the pitch control is changed in CW mode.

One of the outputs from PLL4 is divided by 100 by IC7 (M54459L) and applied to pin 2 of IC8 (SN16913P) of MIX13. In MIX13, it is combined with the 10-MHz reference signal. The resulting signal passes through ceramic filter CF2 to generate a signal of 10.695 MHz and then passes through amplifier Q5 (2SC2714), and is applied to the signal unit as the sub CAR. The other output is applied to pin 5 of IC10 (SN16913P) of MIX5 and used as part of the main CAR.

In PLL9, VCO9 generates a signal of approximately 59.5 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC9 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO9 is applied to pin 11 of IC9, divided by a value determined by N9 internally, and compared with the 2-kHz signal in the phase com-

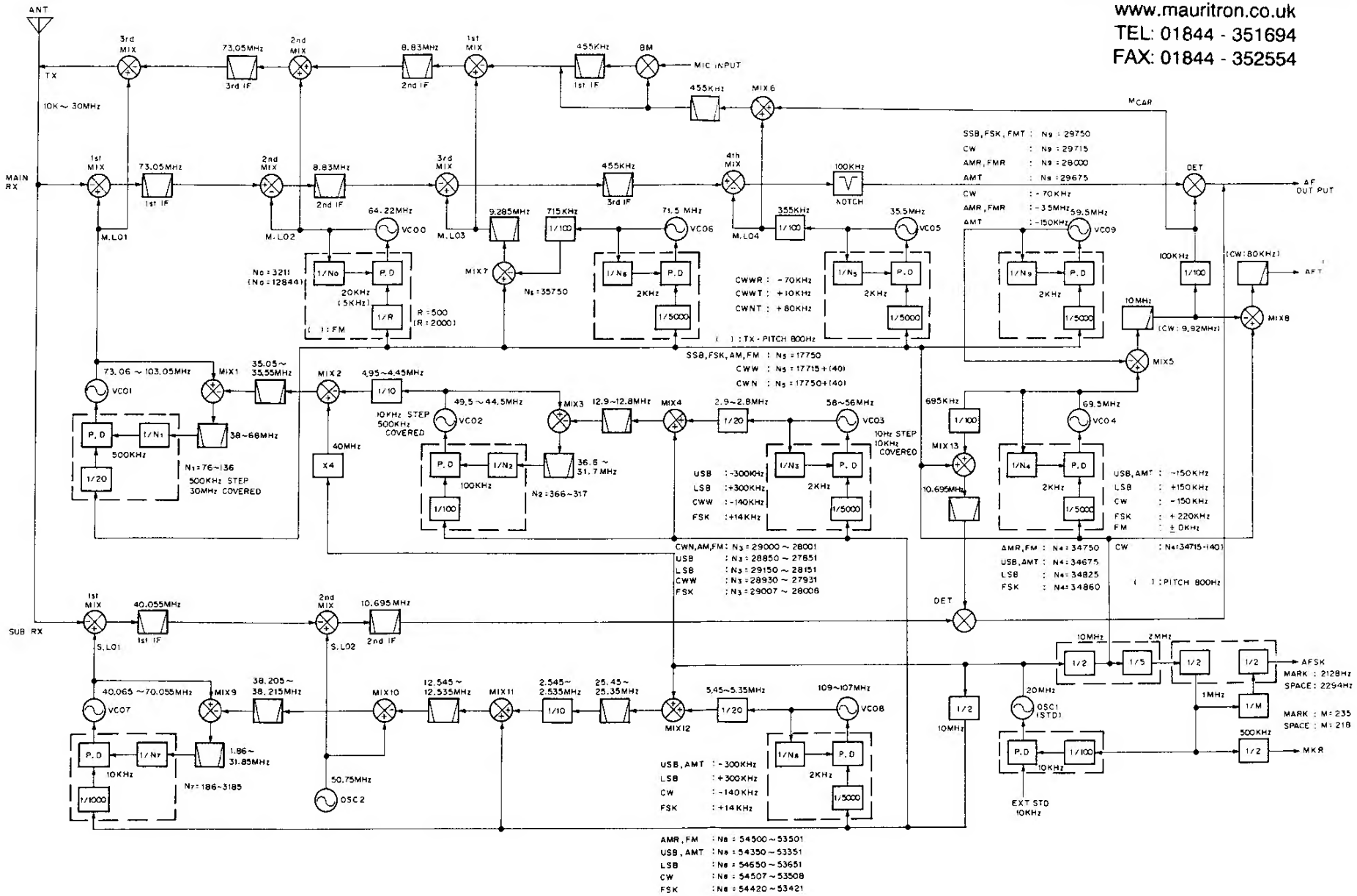


Fig. 2 PLL system frequency configuration

CIRCUIT DESCRIPTION

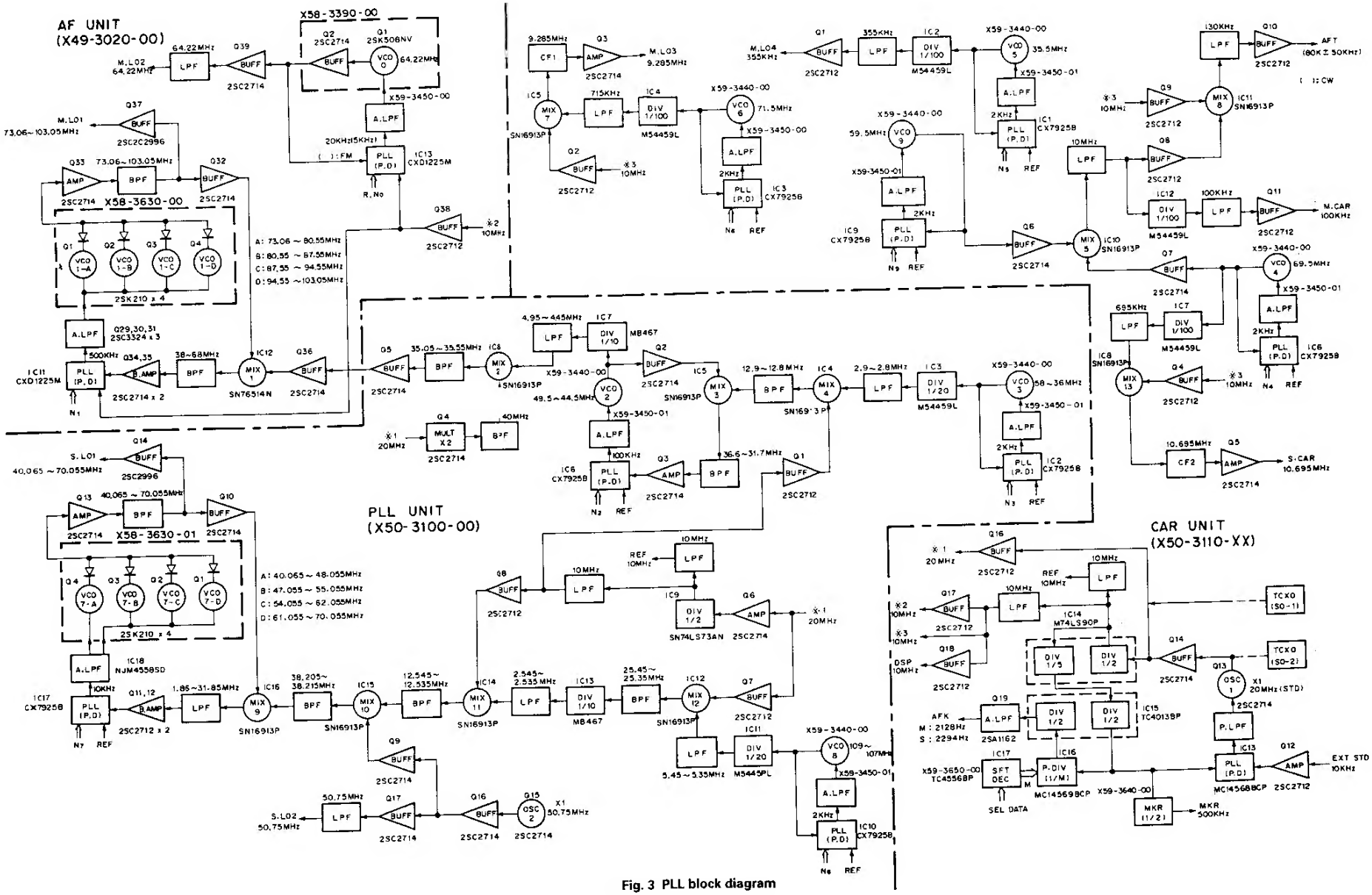


Fig. 3 PLL block diagram

parator locking the VCO9. Divide ratio data N9 is provided by the digital unit. Division ratios are changed in CW, AM, and FM modes so that the VCO9 frequency is shifted as required.

The output from PLL9 is applied to pin 10 of MIX5. Here it is mixed with the output from PLL4, and passes through a low-pass filter to produce a 10-MHz (9.92-MHz in CW mode) signal. One output from PLL9 is divided by 100 by IC12 (M54459L) to generate a 100-kHz (99.2-kHz in CW mode) signal. The signal passes through buffer amplifier Q11 (2SC2712) and is applied to the signal unit as the main CAR.

The other output is applied to pin 2 of IC11 (SN16913P) of MIX8. MIX8 combines it with the 10-MHz reference signal. The signal passes thru a low-pass filter and is then converted to the 80±50 kHz AFT signal used by AF VBT in the CW mode. It then passes through buffer amplifier Q10 (2SC2712) and is applied to the AF unit.

- **Marker signal and AFSK signal**

The 1-MHz signal generated by the reference oscillator circuit of the CAR unit is applied to the MKR module and divided in half internally; the 500-kHz harmonic signal is then applied to the RF unit whenever the calibration (CAL) switch is turned on.

The 1-MHz signal is applied to programmable divider IC16 (MC14569BCP). The divides ratio of IC16 is interlocked with the mark/space condition of the RTTY key jack, and switched between 235/218. The actual shift width is controlled by the decoder output from IC17 (TC4556BP) and the SFT module according to the SEL data provided by the digital unit.

The output from IC16 is applied to IC15 (TC4013BP) and divided in half to make a duty ratio of 50%. This output is connected to the microphone amplifier circuit of the signal unit through the A.LPF of Q19 (2SA1162) to become the AFSK modulation signal. IC16 operation is halted in modes other than FSK mode, resulting in no AFSK signal.

Item	Rating
Nominal center frequency	9.285MHz
3dB attenuation bandwidth	±50kHz or more at 9.285MHz
Guaranteed attenyation	45dB or more at 8.83MHz (–455kHz) 45dB or more at 9.74MHz (+455kHz) 40dB or more at 10.715MHz (+1430kHz)
Insertion loss	6dB or less Formula = $20 \cdot \log\left(\frac{E1}{2 \cdot 2E}\right)$
Ripple	1.0dB or less (within 3dB band)
Input and output impedance	330Ω
Voltage capacity	50V DC (1 minute)

Table 2 Ceramic filter (L72-0350-05) (CAR unit CF1)

Item	Rating
Center frequency (fo) (The center frequency must be the center of the 3dB band)	Within 10.700MHz ± 50kHz
3dB attenuation bandwidth	With in 150 ± 40kHz
20dB attenuation bandwidth	380kHz or less
Insertion loss	With in 8.0dB Formula = $20 \cdot \log\left(\frac{E1}{2 \cdot 2E}\right)$
Ripple (within 3dB band)	1.0dB or less
Spurious attenuation (9 to 12MHz)	38dB or more
Voltage capacity (between pins)	50V DC (1 minute)
Input and output impedance	330Ω

Table 3 Ceramic filter (L72-0369-05) (CAR unit CF2)

Receiver Circuit Configuration

(Refer to block diagram on page 265, 266 and 267.)

The incoming receive signal from the antenna is passed through the transmit/receive selector circuit on the filter unit (X51-3060-XX). The signal is routed to the RX ANT OUT (RCA jack) on the rear panel, and is applied to the RF unit (X44-3100-00) ANT terminal through the rear cable. This signal is applied to the receiver bandpass filter through the RF attenuator (0 to 30 dB selectable) via relays K1 and K2 and the low-pass filter (30 MHz). The bandpass filter divides the receiver frequency range (up to 30 MHz) into 15 bands. The appropriate section is automatically selected by RX bandpass filter control data (RB0, 1, 2, 3) that is supplied from the digital unit (X46-3050-XX).

RX frequency (MHz)	RX BPF Data			
	RB3	RB2	RB1	RB0
0.0 ~ 0.5	1	0	0	1
0.5 ~ 1.6	0	1	0	0
1.6 ~ 3.0	0	0	1	1
3.0 ~ 4.0	0	1	1	0
4.0 ~ 7.0	0	1	1	1
7.0 ~ 7.5	1	0	0	0
7.5 ~ 10.0	0	1	0	1
10.0 ~ 10.5	1	1	1	0
10.5 ~ 14.0	1	0	1	0
14.0 ~ 14.5	0	0	0	0
14.5 ~ 18.0	1	0	1	1
18.0 ~ 21.0	1	1	0	0
21.0 ~ 21.5	0	0	0	1
21.5 ~ 24.5	1	1	0	1
24.5 ~ 30.0	0	0	1	0

Table 4 RX BPF selection data

The signal from the bandpass filter passes through the RF AGC circuit composed of PIN diodes D37 and D38 (MI204). It is then amplified by the RF amplifiers Q5 (2SK125-5) and Q6 (2SK520). (When AIP is on, the signal is directed to RF buffer amplifier Q4 (2SK125) with unity gain, not to RF amplifiers Q5 and Q6.) The amplified signal is separated by L70 for use in the main and sub channels.

CIRCUIT DESCRIPTION

The main received signal passes through buffer amplifier Q12 (2SK520) and a low-pass filter and is then mixed with the VCO signal in the first mixer Q13 to Q16 (2SK520). The output is converted into the first IF signal of 73.05 MHz. This signal is applied to the IF unit (X48-3060-00) from the MIF terminal (CN6) and is separated into two seperate channels. One of the channels passes through the buffer amplifier Q23 (2SC2714) and is combined with the HET signal (64.22 MHz) in mixer Q24 (3SK131) to generate an 8.83-MHz wide-band signal. This signal is routed from the rear as IF OUT1, and is used as a signal for the panoramic display section of the SM-230 station monitor. The other signal passes through buffer amplifier Q44 (2SK520). Undesireable signal components are eliminated from the signal when it passes through the Monolithic Crystal Filter (MCF) XF2 with a bandwidth of 15-kHz . The signal is then applied to the second mixer Q15 and Q16 (2SK520), mixed with the HET signal (64.22 MHz), and converted into the second IF signal (8.83 MHz). This signal is also separated into two channels; one is supplied to the noise blanker on the AF unit (X49-3020-00), and the other is applied to the second IF signal filter circuit via the noise blanker gate composed of diodes D5 to D8 (RLS135).

This filter circuit utlizes wide-band LC filters L28 and L29, a 6-kHz MCF, and a 2.7-kHz MCF (XF3.) The filter circuit permits the use of several optional filters (1.8-kHz and 500-Hz or 250-Hz). (The TS-950SD has these filters included as standard equipment.) These filters can be selected from the front panel via IC8 (TC9174F) of the signal unit (X57-3380-00).

The received signal from the second IF filter, is applied to the third mixer Q19 and Q20 (3SK131) where it is mixed with the HET signal (9.285 MHz). The resulting signal is then converted to the third IF signal (455 kHz) and is routed to the signal unit via the TR455 terminal (CN17).

This 455-kHz signal is then separated into two channels, FM and non-FM. In FM, the signal is amplified by Q1 (3SK131) and applied to the third IF filter circuit. This filter circuit utilizes a 6-kHz ceramic filter (CF1) and 2.7-kHz ceramic (crystal for the TS-950SD) filter (CF101) . Two optional filters are available for this circuit; a 500-Hz and a 250-Hz. (The The TS-950SD type has these filters included as standard equipment.) These filters, like the filters for the second IF, may be selected from the front panel under the control of IC8.

Mode \ Filter	2nd IF filter 8.83-MHz	3rd IF filter 455-kHz
Non-FM	All filters (including LC filter)	Excluding 12 kHz
FM	No display (LC filter) only	12 kHz or 6 kHz

Table 5 Selection of filters by mode (option)

Mode \ Filter	8.83-MHz	455-kHz
SSB, CW, FSK	2.7-kHz	2.7-kHz
AM	6-kHz	6-kHz
FM	– (LC filter)	12-kHz

Table 6 Initial setting

	Display	S type	SD type
8.83 MHz	–	○ (LC filter)	○ (←)
	6 kHz	○ (MCF : L71-0266-05)	○ (←)
	2. 7kHz	○ (MCF : L71-0222-05)	○ (←)
	1.8 kHz	△ (Not sold now)	△ (←)
	500 Hz*	△ (Crystal : YK-88C-1)	○ (←)
	270 Hz*	△ (Not sold now)	X
455 kHz	12 kHz (FM only)	○ (Ceramic : L72-0315-05)	○ (←)
	6 kHz	○ (Ceramic : L72-0319-05)	○ (←)
	2.7 kHz	○ (Ceramic : L72-0333-05)	○ (Crystal : YG-455S-1)
	500 Hz	△ (Crystal : YG-455C-1)	○ (←)
	250 Hz	△ (Crystal : TG-455CN-1)	○ (←)

* : Only one of them is selectable.

○ : Standard
△ : Option
X : Not available

Table 7 Filters by type

The 455-kHz signal from the third IF filter is amplified by Q2 (3SK131), and is mixed with the CAR signal (355 kHz) in the fourth receive mixer Q3 (3SK131). The signal is converted into the fourth IF signal of 100 kHz, and passes through the notch filter circuit, and is then applied to Q4 (3SK131). The amplified output from Q4 becomes the AF signal after passing through the SSB/CW detector, and is applied to the SCAF terminal (CN7).

The output of Q2 is applied to Q22 (2SC2712), to become the squelch signal for non-FM receive modes by comparator IC2 (NJM2903M). The output of Q4 is also applied to Q10 (2SC2712) to produce the Automatic Gain Control AGC signal.

In the FM mode, the 455-kHz signal passes through IF buffer amplifier Q28 (2SC2712), and is applied to the third IF circuit. Either wide-band filter CF2, for a 12-kHz bandwidth, or narrow-band filter CF3, for a 6-kHz bandwidth, may be selected. The output is amplified by limiter amplifiers IC6 and IC7 (μPC577H), and then FM-detected by ceramic discriminator CF4.

The noise components, at approximately 40 kHz, are eliminated from the FM detector output, and a squelch circuit consisting of noise amplifier Q19 and Q20 (2SC2712) and comparator IC2 (b/2) produces an FM squelch control signal.

CIRCUIT DESCRIPTION

The FM AF signal passes through the de-emphasis circuit, and is then amplified by the FM AGC amplifier IC3 (μPC1158H2). If the deviation of the ANT input is 3 kHz or more, the circuit keeps the audio output constant and prevents large changes in volume. The FM AF signal and the AM AF signal detected by D21 and D22 (RLS73) are routed from the FAAF terminal.

The AF signal from the SCAF or FAAF terminal is applied to the AF unit (X49-3020-00). The AF signal from the SCAF terminal is routed differently from the signal from the FAAF terminal. The signal from the SCAF terminal is processed by the DSP and CW VBT circuit, and is then applied to the AF amplifier IC7 (a/2). The signal from the FAAF terminal is applied directly to the AF amplifier IC7 (a/2).

The sub receiver signal passes through buffer amplifier Q7 (2SK520) and the low-pass filter of the RF unit. The signal is mixed with the sub VCO signal in the first sub mixer Q8 to Q11 (2SK520), and the output is converted into the first sub IF signal of 40.055 MHz. The unwanted signal components are eliminated from the signal when it passes through the MCF XF1 with a 15-kHz bandwidth. When the monitor is on, the RF transmit signal is applied to the first sub mixer.

The signal applied to the IF unit from the SUB IF terminal (CN7) is amplified by Q1 (3SK131), mixed with the HET signal (50.7 MHz) in mixer Q2 and Q3 (2SK520), and converted to the second IF signal (10.695 MHz). This signal is separated into two channels; one is supplied to the noise blanker circuit, the other is amplified by the second IF amplifier Q5 (3SK131), which also acts as a noise blanking gate, and passes through the 10.695-MHz crystal filter XF1. The signal is further amplified by the second IF amplifiers Q9 and Q10 (3SK131), product-detected by IC1 (AN612), and routed from the SAF terminal (CN15) as an AF signal.

This sub AF signal is applied to the AF unit, where it is separated into two channels; one for sub reception and one for the monitor. For sub reception, the signal is applied to IC7 (b/2). For the monitor, the signal is routed to the monitor VR.

The main AF and sub AF signals are amplified separately by IC7, passed through the muting circuit Q8 and Q9 (2SD1757K), and are applied to the main and sub AF VR. In the CW mode, the sub AF can also be routed through the AF VBT circuit.

The AF signal that has passed through the AF VR is mixed with the signal that has passed through the monitor VR in IC8 (a/2; NJM4558M). The resulting signal is amplified and applied to the control unit (X53-3230-00) via the AF terminal (CN11), and amplified by the AF power amplifier IC7 (μPC2002V) in order to drive the speaker.

- **Filters ratings**

Item	Rating
Nominal center frequency	8.830MHz
3dB attenuation	±50kHz or more at 8.830MHz
Guaranteed attenuation	35dB or more at 9.285MHz (+455kHz) 45dB or more at 9.74MHz (+910kHz)
Insertion loss	6dB or less Formula = $20 \log \left(\frac{E1}{2\ 2E}\right)$
Ripple	1.0dB or less (within 3dB band)
Input and output impedance	330Ω

Ceramic filter (L72-0351-05) (IF unit CF1)

Item	Rating
Nominal frequency	10.695MHz
Center frequency deviation	Within ±200Hz at 6dB
Passband width and attenuation bandwidth (minimum loss standard)	2.2kHz or more at 6dB ±1.5kHz or less at 20dB ±2.4kHz or less at 60dB
Ripple	2dB or less
Insertion loss	5dB or less
Guaranteed attenuation	60dB or more within ±40kHz
Input and output impedance	1.2kΩ ± 5% / 6pF ± 5%

MCF (L71-0249-05) (IF unit XF1)

Item	Rating
Nominal center frequency	73.05MHz
Pass bandwidth	±7.5kHz or more at 3dB
Attenuation bandwidth	±30kHz or less at 40dB
Ripple	1.0dB or less
Insertion loss	3.0dB or less
Guaranteed attenuation	70dB or more at fo + (500 to 1000) kHz 70dB or more at fo – (200 to 1000) kHz
Center frequency deviation	Within ±1.5kHz at 3dB
Input and output impedance	2kΩ ± 10%

MCF (L71-0401-05) (IF unit XF2)

Item	Rating
Nominal center frequency	8830kHz
Center frequency deviation	Within ±150Hz at 6dB
Passband width	±1.3kHz or more at 6dB
Attenuation bandwidth	±1.7kHz or less at 20dB ±2.5kHz or less at 60dB ±3.4kHz or less at 80dB
Ripple	2dB or less
Insertion loss	6dB or less
Guaranteed attenuation	80dB or more in the range ±3.4kHz to ±1MHz
Input and output impedance	600Ω / 15pF

MCF (L71-0222-05) (IF unit XF3)

CIRCUIT DESCRIPTION

Item	Rating
Nominal center frequency	455 ± 0 20kHz
6dB bandwidth	2 9 to 3 2kHz
60dB bandwidth	4 7kHz or less
Guarateed attenuation	60dB or more at 0 1 to 1MHz
Spurious	40dB or more at 600 to 700kHz
Ripple (in 6dB band)	2dB or ess
Insertion loss	6dB or less
Guaranteed attenuation	60dB or more within ±40kHz
Input and output impedance	2kΩ

Ceramic filter (L72-0333-05) (Filter unit CF1)

Item	Rating
Nom nal center frequency	455kHz
6dB bandwidth	±6kHz or more (at 455kHz)
50dB bandwidth	±12 5kHz or ess at 455kHz)
Ripple (within 455 ± 4kHz)	3dB or less
Insertion loss	6dB or ess
Guaranteed attenuation (within 455 ± 100kHz)	35dB or more
Input and output impedance	2 0kΩ

Ceramic filter (L72-0315-05) (Signal unit CF2)

Item	Rating
Nominal center frequency (fo)	8830kHz
Pass bandwidth	fo ± 3 0kHz or more at 6dB
Attenuation bandwidth	fo ± 16 0kHz or less at 60dB fo ± 13 0kHz or less at 50dB
Guaranteed attenuation	70dB or more within fo ± 1MHz
Ripple	W th n 1 0dB
Insertion loss	Within 1 5dB
Input and output impedance	1850Ω / 2pF

MCF (L71-0266-05) (Filter unit XF1)

Item	Rating
Nominal center frequency (fo) and deviation	40.055MHz ± 0 75kHz or ess
Pass bandwidth	fo ± 7.5kHz or more at 3dB
Attenuation bandwidth	30dB or more at fo ± 25kHz 60dB or more at fo ± 150kHz (Spurious 30dB or more)
Guaranteed attenuation	60dB or more at fo ± 150kHz to fo ± 1000kHz
Ripple	1.5dB or ess
Insertion loss	4dB or less
Input and output impedance	4 2kΩ / -1pF

MCF (L71-0275-05) (RF unit XF1)

Item	Rating
Nominal center frequency	455kHz
6dB bandwidth	±3kHz or more (at 455kHz)
50dB bandwidth	±9kHz or less (at 455kHz)
Ripple (within 455 ± 2kHz)	2dB or less
Insertion loss	6dB or less
Guaranteed attenuation (within 455 ± 100kHz)	60dB or more
Input and output impedance	2.0kΩ

Ceramic filter (L72-0319-05) (Signal unit CF1, 3, 5)

Item	Rating
Nom nal center frequency	8830 0kHz
Center frequency deviation	W th n ±70Hz at 6dB
Pass bandwidth	+250Hz or more at 6dB
Attenuation bandwidth	±900Hz or less at 60dB
Guaranteed attenuation	80dB or more within ±2kHz to ±1MHz
Ripple	2dB or ess
nsert on loss	W th n 5 + 2dB
Input and output impedance	600Ω / 15pF

Crystal filter YK-88C-1 (L79-0847-05) : Option

Item	Rating
Nom nal center frequency	455kHz
Center frequency deviation	W th n 50Hz at 6dB
Pass bandwidth and Attenuation bandwidth	+250Hz or more at 6dB ±425Hz or less at 60dB
Guaranteed attenuation	80dB or more within 100Hz to 454 4kHz 80dB or more with n 455 6kHz to 2MHz
Ripple	2dB or ess
nsert on loss	6dB or less
Input and output impedance	2kΩ ± 5% / 15pF ± 5%

Crystal filter YG-455C-1 (L79-0888-05) : Option

Item	Rating
Nomina center frequency	455kHz
Center frequency deviation	Within 50Hz at 6dB
Pass bandwidth and Attenuation bandwidth	±125Hz or more at 6dB ±250Hz or ess at 60dB
Guaranteed attenuation	80dB or more w thin 100Hz to 454 6kHz 80dB or more within 455 4kHz to 2MHz
Ripple	2dB or less
Insertion oss	6dB or ess
Input and output impedance	2kΩ ± 5% / 15pF ± 5%

Crystal filter YG-455CN-1 (L71-0239-05) : Option

Item	Rating
Nominal center frequency	455kHz
Pass bandwidth and Attenuation bandwidth	±1 2kHz or more at 6dB ±1 5kHz or less at 20dB ±2 05kHz or ess at 60dB ±2 1kHz or less at 66dB
Guaranteed attenuation	60dB or more with n ±20kHz
Ripple	3dB or ess
Insert on loss	6dB or less
Input and output impedance	2kΩ ± 5% / 15pF ± 5%

Crystal filter YG-455S-1 (L71-0292-05) : Option

CIRCUIT DESCRIPTION

- **SLOPE-TUNE, IF VBT**

Figure 4 shows the TS-950 SLOPE-TUNE and IF VBT receiver configuration

The operating principle of SSB-SLOPE-TUNE circuit is explained first. When f_{ML1}, f_{ML3}, and f_{ML4} in Figure 5 are at their normal frequencies, the synthesized bandwidth is indicated by A. When the frequencies of f_{ML3} and f_{ML4} are lowered by an amount equal to $\Delta f1$, only the third IF filter (455-kHz band) shifts to position B. (The circuit is designed so that the PLL data lowers the frequencies of f_{ML3} and f_{ML4} equal to the value determined by $\Delta f1$.) The synthesized bandwidth is the overlapping portion of A and B. When the frequencies of f_{ML1} and f_{ML3} are lowered by an amount equal to $\Delta f2$, only the the second IF filter (8.83-MHz band) shifts to position C The synthesized bandwidth is the overlapping portion of B and C The SSB-SLOPE-TUNE allows these operations to be conducted independently, using two separate controls.

The frequencies are generated by the PLL circuit and controlled by the microprocessor. The amount of change in $\Delta f1$ and $\Delta f2$, is digitally tracked, allowing only the bandwidth to narrow without changing the center frequency of the composite passband.

We will now cover the operating principle of the SSB-SLOPE-TUNE circuits. These circuits are designed so the relationship between the frequency changes of PLL data are such that $\Delta f2 = \Delta f1$. The synthesized passband widths of the third IF filter (f_{IF3}) and the second IF filter (f_{IF2}) can thus be varied by a single control.

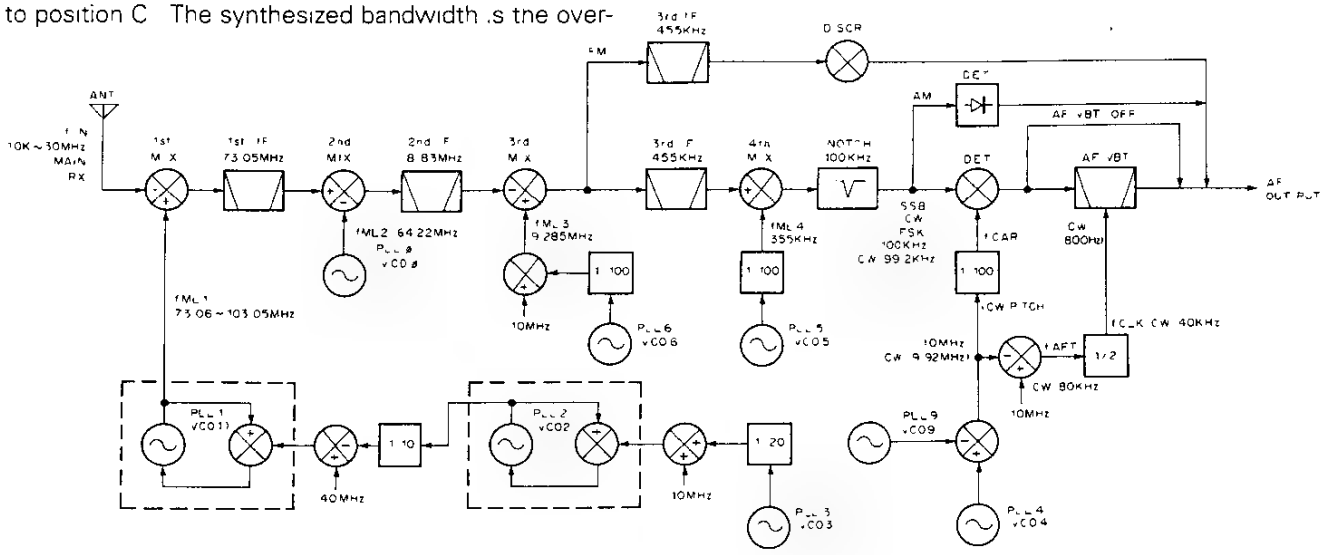


Fig. 4-a Main receiver frequency configuration

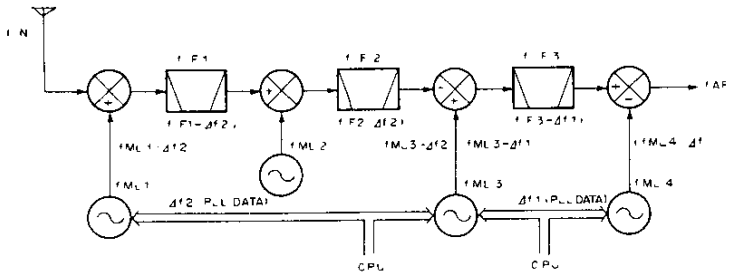


Fig. 4-b Band variable frequency configuration

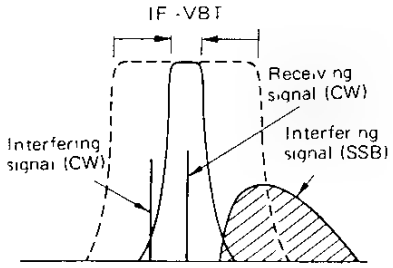


Fig. 4-c IF VBT

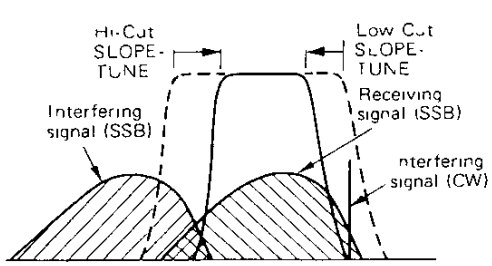


Fig. 4-d SSB-SLOPE-TUNE

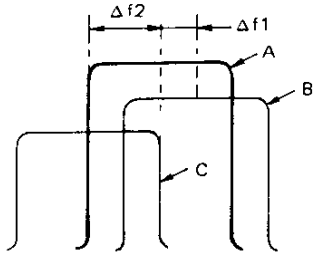


Fig. 5

CIRCUIT DESCRIPTION

- **Noise blanker circuits**

1) NB1

NB1 is a noise blanker circuit that has been designed for short-duration pulse noise, such as automobile ignition noise. The 8.83-MHz IF signal generated from the first main IF of 73.05 MHz is amplified by noise amplifiers Q40 (2SK210), Q41, Q42, and Q44 (2SC2712), passes through buffer amplifier Q45 (2SC2712), and is noise-detected by D30 (HSM88AS). This signal is used to switche Q47 (2SC2712), turns on Q48 (DTA124EK), and switches the main IF signal line according to the incoming noise pulses. The signal is also used to turn on Q48, which turns on IF unit Q8 and Q6 (2SC2712), and switches the sub IF signal lineccording to the main noise.

The 10.695-MHz IF signal generated from the first sub IF of 40.055 MHz is amplified by noise amplifiers Q26 (2SK210), Q27, Q28 and Q29 (2SC2714) of the IF unit, passes through buffer amplifier Q31 (2SC2714), and is noise-detected by D33 (HSM88AS). This signal is used to switche Q33 (2SC2712), turns on Q34 (DTA124EK), switches Q8 and Q6, and switches the sub IF signal line according to the incoming noise. The signal turns on Q34 (DTA124EK), and switches the main IF signal line ccording to the sub noise.

When NB1 turns on, a DC voltage is applied to the emitter of Q47 on the AF unit from threshold variable resistor VR12 for the main reciever. A corresponding DC voltage is applied to the emitter of Q33 on the IF unit from threshold variable resistor VR12 for the sub receiver. The effect of the NB circuit can be adjusted by changing these emitter voltages.

2) NB2

NB2 is a noise blanker circuit that is used to blank noise pulses with a comparatively long duration and a large pulse width, like the Russian woodpecker.

For the main receiver NB2 circuit, the noise signal amplified by noise amplifiers Q40, Q41, Q42, and Q44 of the AF unit is noise-detected by D28 (HSM88AS) in a manner very similar to that of NB1. The threshold voltage of emitter Q46 (2SC2712) is varied by VR12 The output from Q46 enters the NB2 module unit (X59-3350-00) and is used to generate the pulse width and period synchronized with the woodpecker noise.

For the sub receiver NB2 circuit, the noise signal amplified by noise amplifiers Q26, Q27, Q28, and Q29 is noise-detected by IF unit D32 (HSM88AS) in a manner very similar to that of NB1 The threshold voltage of emitter Q32 (2SC2712) is varied by VR12 The output from Q32 enters the NB2 module unit (X59-3350-00) and is used to generate the pulse width and period synchronized with the woodpecker noise.

The NB2 switching signal detected by the main IF, and the NB2 switching signal detected by the sub IF switch the main and sub IF signal lines in a manner very similar to NB1.

IC1 (TC4011BF), 1/4, 4/4, and 2/4, 3/4 in the module unit are set to a pulse width of 40 ms. Normally, woodpecker noise has a pulse width of 3 to 4 ms and a period of from 80 to 100 ms. Some woodpecker noises have a period of about 50 ms, although this is rare. Therefore, even a woodpecker noise signal, with a large pulse width can be blanked by switching the noise in 5-ms intervals. However, if a noise signal, with a period of several ms like an ignition noise is blanked at a 5 ms interval, the signal receive time becomes zero. To prevent this, a one-shot multi-vibrator composed of IC1 2/4 and 3/4 is provided so that the next pulse is not blanked for a period of 40 ms after the one shot is issued from 1/4 and 4/4.

CIRCUIT DESCRIPTION

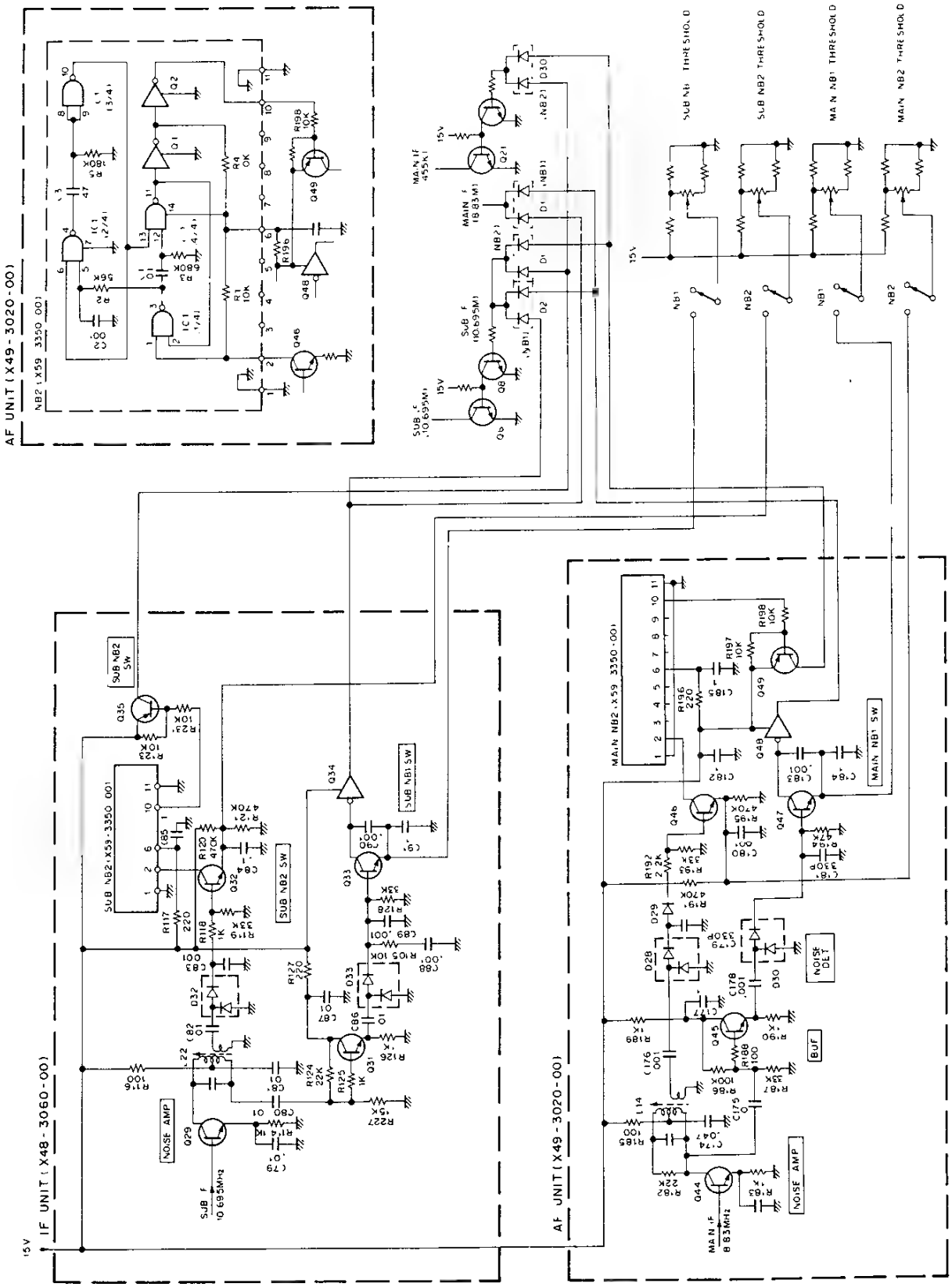


Fig. 6 Noise blanker circuit configuration

CIRCUIT DESCRIPTION

Transmitter Circuit Configuration

The transmitter system configuration is shown in Figure 7. The transmitter system operates as a triple conversion system in SSB, CW, and AM modes, and as a double conversion system in FM mode.

The audio signal from the microphone enters switch unit (A) (D/10) and switch unit (A) (H/10) from the microphone connector board. The signal is amplified by the MIC AMP module and passes through buffer amplifier Q17 (2SC2712) and splits into the SSB/AM MIC system, and the FM, VOX system. Inputs from the rear panel enter from the PHONE IN and ACC2 lines on the IF unit, are amplified by Q42 (2SC2712), and then matched with the input of Q17 on the switch unit (A) (H/10).

The SSB and AM MIC system of switch unit (A) (H/10) is routed to the MIC GAIN VR and the PROC IN VR on the same board. When the speech processor is turned on, with switch S59 of switch unit (A) (G/10), PROC IN is selected. When the speech processor is turned off, the MIC GAIN output is selected.

The FM and VOX signals of switch unit (A) (H/10) are switched to the FM and VOX systems by switch unit (A) (E/10). The FM signal enters the FM MIC AMP circuit of the AF unit, and the VOX signal enters the VOX circuit of the AF unit via the VOX GAIN VR of switch unit (A) (E/10).

The SSB and AM MIC signals enter the signal unit and are amplified by IC9 (TA7140P) to a level sufficient for modulation, and are then modulated by ring modulator D41 (ND487R1-3R) to produce a 455-kHz DSB signal. In the AM and CW modes, D41 is used as a carrier attenuator by applying DC bias to D41. The carrier level is adjusted by changing the level of VR11 CAR LEVEL VR on switch unit (A) (J/10). In the FM mode, the carrier level is set by VR6 (FMC) on the signal unit.

The DSB signal is amplified by Q12 (3SK131) on the signal unit, and is passed through ceramic filter CF101. The unwanted side band is eliminated in order to generate a 455-kHz SSB signal. The FM and FSK signals also pass through CF101. The CW and AM signals pass through CF1. The 455-kHz signal passes through buffer amplifiers Q26 and Q25 (2SC2712x2), and are routed from the signal unit.

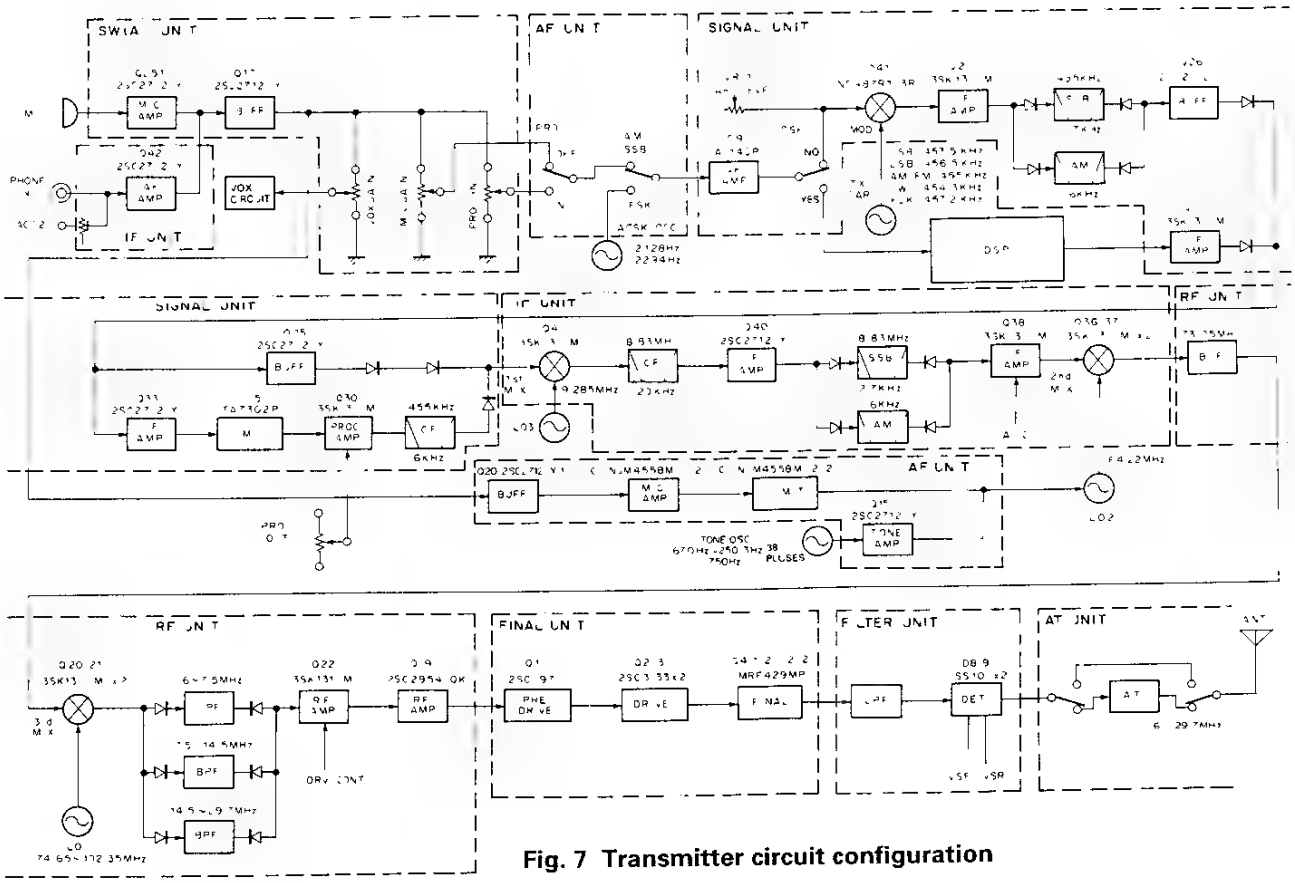


Fig. 7 Transmitter circuit configuration

CIRCUIT DESCRIPTION

The speech processor can be turned on and off only in the SSB mode. In FSK, the processor is automatically switched into the circuit. When the speech processor is on, the SSB signal obtained from the output of Q26 is amplified by Q33 (2SC2712), and the components above a specific level are clipped. The resulting signal is amplified by Q30 (3SK131). The output level of the speech processor is varied by changing the second gate voltage on Q30. The output level is controlled by the PROC OUT control on switch unit (A) (H/10). The processor output from Q30 passes through ceramic filter CF5, and is output when processor Q25 is turned off by D60, D61, and D62 (RLS73x3). The signal then exits the signal unit.

The signal supplied from the signal unit enters the IF unit and is mixed with the third local oscillator signal of 9.285 MHz by Q41 (3SK131) to obtain an 8.83-MHz IF signal. This signal passes through ceramic filter CF1 with the NULL point set at 9.285 MHz, amplifier Q40 (2SC2712) for matching the signal to the next ceramic filter XF3 (YK-88S), and the 8.83-MHz IF filter. The SSB, FM, FSK signals passe through XF3 (YK-88S), and the CW and AM signals pass though the filter unit (C/3). The output from the filter is amplified by Q38 (3SK131). ALC is applied to Q38.

The output from Q38 is mixed with the second local oscillator signal of 64.22-MHz in Q36 and Q37 (3SK131x2) to generate a 73.05-MHz signal. This signal enters the RF unit from the IF unit.

In the RF unit, the signal passes through three LC bandpass filters, L93, L94, and L95, is mixed with the first local oscillator signal in Q20 and Q21 (3SK131x2), and is converted to the target transmit frequency. The output of Q20 and Q21 passes through a bandpass filter, which is split to three frequency ranges (7.5 MHz, 7.5 to 14.5 MHz, 14.5 to 30 MHz; the 7.5 MHz section covers all frequency below 7.5 MHz), amplified by Q22 (3SK131) and Q19 (2SK2954), and routed from the DRIVE OUT terminal on the rear panel. The signal enters the final unit via the DRIVE IN terminal through the jumper cable at the rear.

The signal is amplified by Q1 (2SC1971), Q2 and Q3 (2SC3133x2), Q4 (1/2, 2/2) (MRF429MP). Harmonics are eliminated from the signal by the filter unit, and the signal is emitted from the antenna.

FSK is based upon AFSK methods with the mark (2125 Hz) or space (2295 Hz) being generated by the carrier unit or the AFSK signal is input to signal unit IC9 and modulated by D41. In the FSK mode, the speech processor circuit works, providing 10- to 20-dB of compression, and also suppresses the difference in the levels between the mark and space signals.

The FM signal passes through buffer amplifier Q20 (2SC2712) and the FM MIC AMP module in the AF unit, and is used to modulate the second local oscillator.

- **ALC circuit**

The level of the forward wave voltage (VSF) detected in the filter unit may be adjusted by VR12 (VSF) on the control unit and is applied to the different a amplifier composed of Q10 and Q11 (2SC2712x2).

When VSF is applied to the base of Q10, the emitter voltages of Q10 and Q11 increase and the current through the base of Q11 decrease which causes the collector voltage of Q11 to rise. When this voltage exceeds the emitter voltage of Q1 (2SC2712) (about 1.8 V; stabilized by D1 [LT8001P]), the current begins to flow thru the base of Q1, dropping the on the collector. The ALC time constant RC circuit is connected to this collector. The change in the collector voltage is shifted by approximately 2.7 V by Q4 (2SK208) and D5 (RLZJ4.7B), and matched with the voltage for keying by Q5 (2SC2712) and D6 (RLS73) to generate the ALC voltage. This ALC voltage activates the ALC by lowering the second gate voltage of Q38 (3SK131) of the F unit.

- **Power control circuit**

Power is controlled (reduced) by lowering the base voltage of Q11. As the base voltage of Q11 is decreased, the emitter voltages of Q10 and Q11 are decreased. This allows Q10 to be turned on even if the base voltage (VSF) of Q11 is low. That is, ALC works to lower the power even if the power is already relatively low.

When the power output is maximum, Q16 (DTC124EK) is on, Q12 and Q14 (DTC124EKx2) are off, and VR2 (PWR VR) of the switch unit (A) (H/10) is shorted. Therefore, the base voltage of Q11 has the value determined by voltage dividers R66, R67, and front panel PWR VR. When the PWR VR is turned to MIN, the base voltage of Q11 is lowered, and ALC begins with low power. When the PWR VR is set to MIN, VR10 (MIN) and the PWR VR of the control unit are parallel, and the MIN power setting can controlled by VR10.

For AT tuning, the power is lowered to about 10 W. The AT start signal (ATS) turns on Q14, and the base of Q11 is connected to ground via R72 to lower the power.

Q15 (DTC124EK) is used to turn off the PWR VR control to prevent the PWR VR from influencing tuning.

CIRCUIT DESCRIPTION

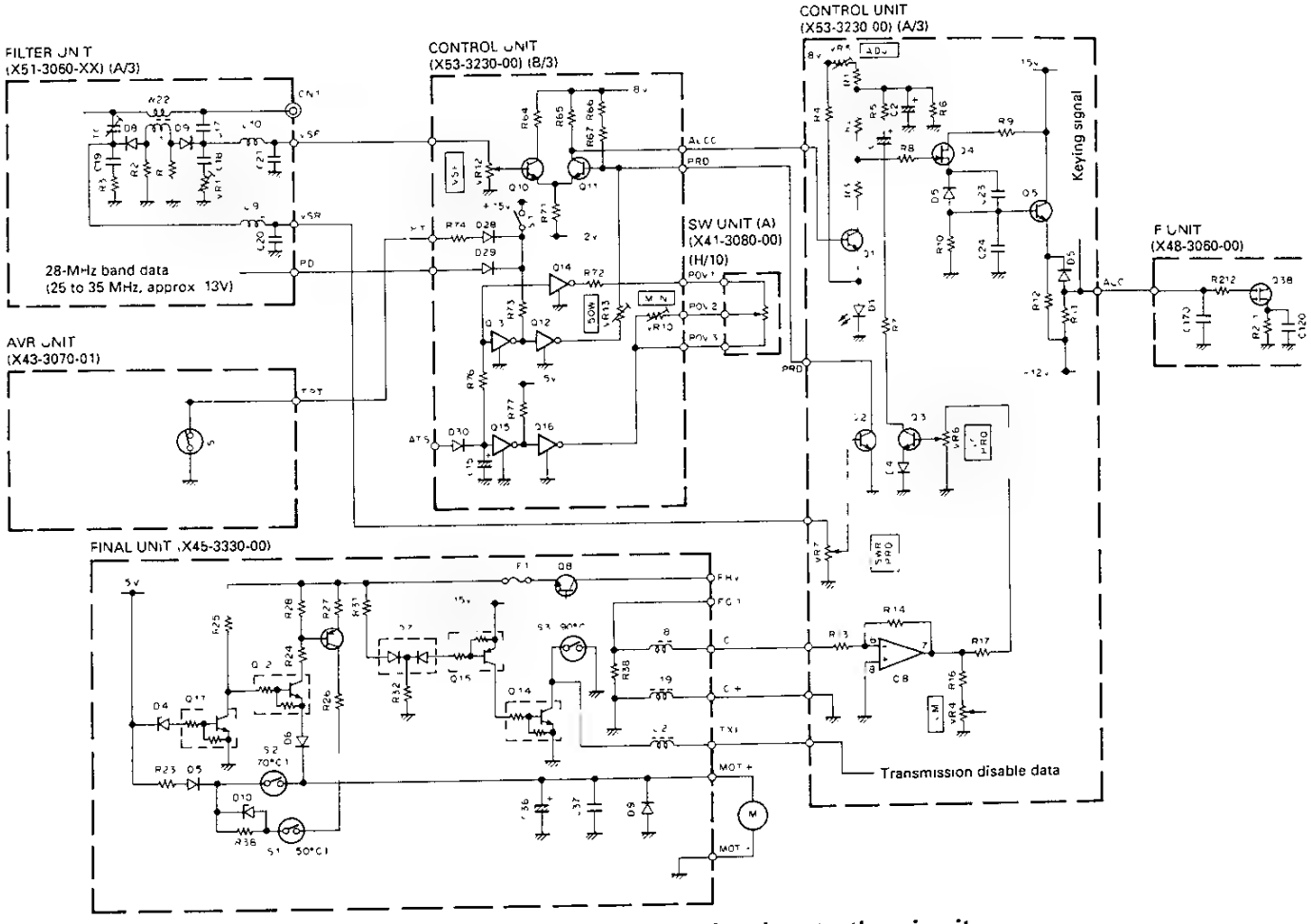


Fig. 8 ALC, power control and protection circuit

If the power output control is used only when ALC action begins, its range increases as the power output is lowered. Therefore, the switch unit (A) (H/10) PWR VR has two functions; one controls ALC, and the other changes the second gate voltage (PCV) of Q22 (3SK131) on the RF unit. By changing the gate voltage, the difference between the maximum and minimum gains is approximately 10 dB to prevent excessive ALC action when the power output is low.

The gain is also reduced during AT tuning. When the ATS signal arrives at the RF unit, PCV is grounded at Q25 (DTC124EK) to eliminate the influence of PWR VR, and the second gate voltage is made constant (nearly the same value as when the PWR VR is MIN).

- **Protection circuit**

1) SWR protection

When the reflected wave voltage (VSR) from the filter unit is raised by load variation or AT tuning, Q2 (2SC2712) of the control unit turnes on, and the voltage on the ALC time constant circuit is decreased. The power output is lowered by decreasing the drive to protect the final transistor.

CIRCUIT DESCRIPTION

2) IC protection

The final transistor collector current is detected via the voltage drop across R38 of the final unit. Since the detected voltage is negative, it is inverted and amplified by IC8 (NJM4558M) on the control unit. IC8 turns on Q3 (2SC2712), reduces the voltage on the ALC time constant circuit, and decreases the drive to limit the final transistor current

When the fuse on the final unit blows, the 50-V AVR is turned off, TXI is grounded by D7 (MC921), Q15 (DTA124ES), and Q14 (DTC124ES), and disabling transmission

- **Temperature protection**

If the final heat sink temperature rises to approximately 50°C, the temperature switch (S1) of the final unit turns on. Current then flows to the fan motor through R23 and D5 (1S1555), and R36 and D10 (UPZ4.7B), and the fan motor starts running at a low speed. D10 is a zener diode that produces the current necessary for starting the motor.

If the final heat sink temperature rises to approximately 70°C, temperature switch S2 turns on, and D10 and R36 are shorted. The voltage applied to the motor then increases and the fan motor runs at higher speed. If the sink temperature reaches 90°C through some failure, S3 turns on, TXI is grounded, and transmission is disabled.

If the power transformer temperature rises to approximately 80°C, temperature detection switch S1 of the AVR unit turns on and the power is lowered to protect the transformer.

- **Safety discharge cooling circuit**

70 to 80 V is applied to the electrolytic capacitor of the power supply whenever the power switch is turned on. This capacitor will not discharge immediately when the power switch is turned off. Since the voltage on the 15-V power supply soon falls when the power supply is turned off, the voltage remaining on this capacitor will be consumed by the fan motor.

The fall in voltage on the 15-V power supply line is detected by D4 (MTZ4.7JC) on the final unit If the voltage drops to approximately 10 V, Q11 (DTC124ES) turns off, the collector voltage rises, and Q12 (DTC143TS) turns on. When Q12 turns on, Q13 turns on allowing the voltage to discharge slowly through R27, Q13, R26, D6 keeping the fan on .

- **Monitor circuit**

1) Modes other than FM

The monitor circuit uses the sub receiver to receive and monitor the signals after conversion to the transmission frequency unlike conventional monitor circuits that monitor the IF signals. This monitor circuit produces the same audio signal that is transmitted and monitored by another receiver (In the AM mode, the signal passes through the SSB filter for product detection.)

The signal taken from the bandpass filter output before Q33 of the RF unit is applied to the first mixer (Q8 to Q11) of the sub receiver via D49. Since the level might be too high, it is attenuated by Q37 when the signal is determined to be too large, and is further attenuated by Q4 in the IF unit. The amount of attenuation in the IF unit can be adjusted by VR1, and the degree of AGC can also be changed

The sub receiver output SAF passes through IC6 (c/4) and IC10 (d/4) of the AF unit, and is applied to IC8 (a/2) via the monitor control. It is amplified and routed in the same manner as an signal. To cut off noise entering IC8 when transmissions are not monitored, analog switch IC6 (b/4) is shorted to ground until the monitor circuit is again turned on.

2) FM mode

The signal output (pin 2), having passed through the clipper and preemphasis circuit in the FM microphone amplifier circuit (X59-3000-03), is applied to the deemphasis circuit. The resulting signal passes through IC10 (c/4), applied to the IC10 (d/4) input (pin 10), and is amplified and routed as for the other modes.

CIRCUIT DESCRIPTION

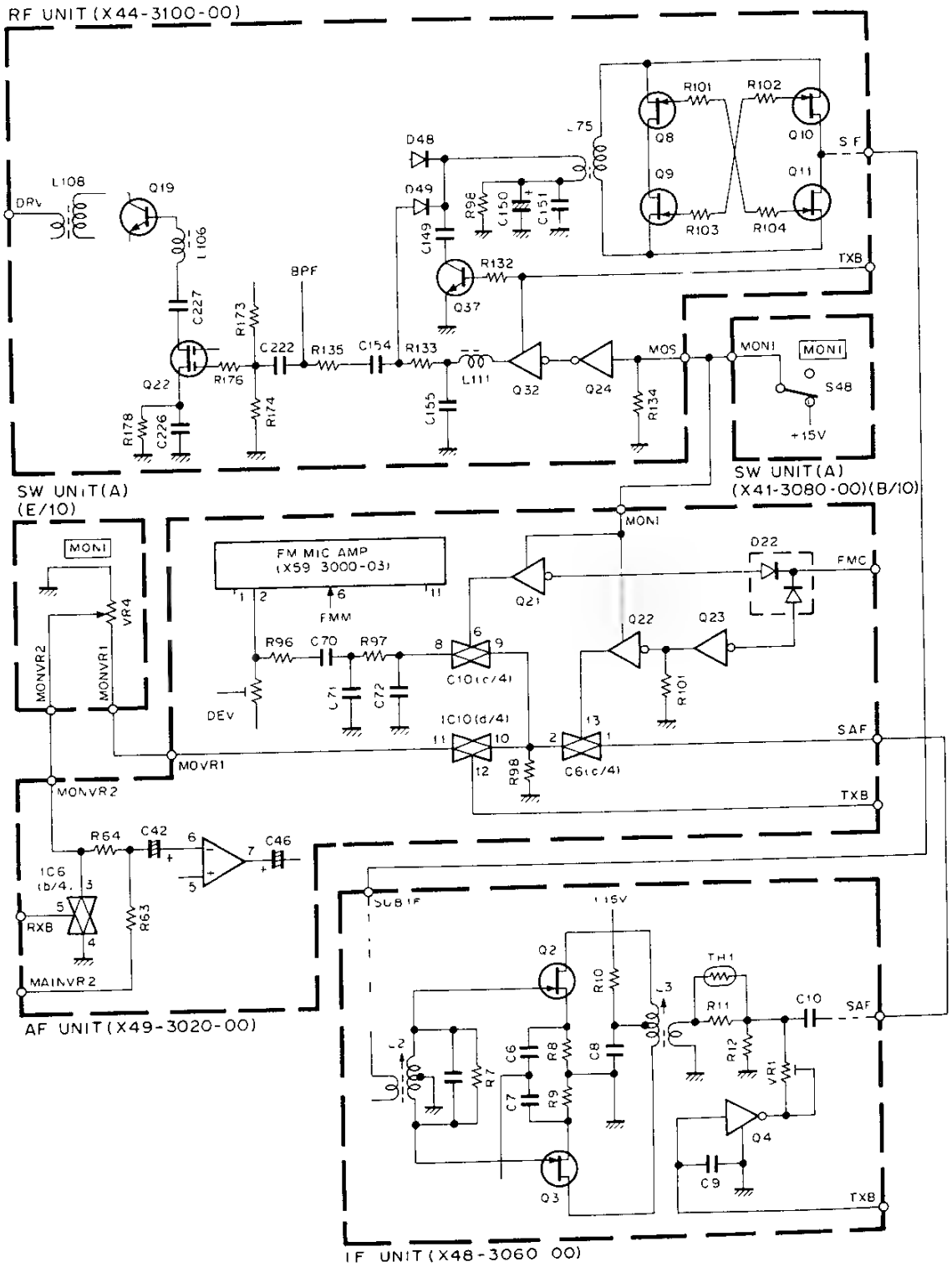


Fig. 9 Monitor circuit

CIRCUIT DESCRIPTION

- **Side tone generation circuit**

The AFT signal (80 kHz when the PITCH control is at the center; the frequency is changed within ±50 kHz by turning the control; 150 kHz in the SSB mode) generated by the CAR unit is rectified by Q1. The square wave of 800±500 Hz divided to 1/100 by IC1 is applied to switched capacitor filter IC3 to obtain a sine wave interlocked with the CW receive pitch.

The 40±25 kHz obtained by dividing the AFT signal in half with IC1 is sent to the clock that determines the center frequency of IC3.

Keying the transceiver switches Q7 via the KEY line from the control unit (high when the key is down). This forward biases muting transistor Q6 to produce the intermittent sine waves.

When the monitor is on, Q6 is biased through R27 and side tone is turned off.

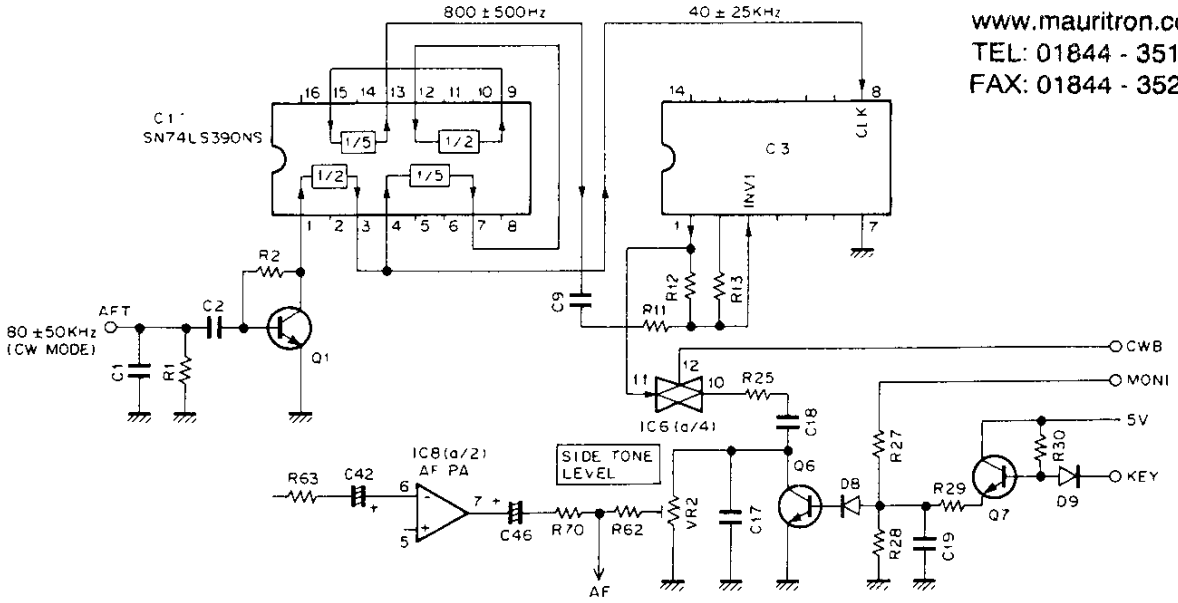


Fig. 10 Side tone circuit

- **AF VBT circuit (AF unit)**

Filter IC2 (MF10CCWM) is inserted into the AF amplifier circuit in order to eliminate radio interference. This circuit functions only in the CW mode when the AF TUNE switch is on.

The center frequency of this filter is changed when the pitch of the receiver side tone is varied with the PITCH control. The Q of the filter circuit can be changed in conjunction with the AF VBT control.

When SSBC or FSKC goes low in a mode other than FM or AM, Q3 turns on via D3, and IC5 (a/4) and (b/4) turn on. When CWB goes high in the CW mode, IC5 (a/4) and (b/4) turn on via R20 and D1. (Preventing the signal from passing through filter IC2.)

If the AF TUNE button is pressed, AFTSW goes high, Q4 tuns on, and IC5 (a/4) and (b/4) turn off. Since CWC is low, Q5 turns on and IC5 (c/4) and (d/4) turn on. The output of the filter circuit selected by IC2 is controlled by analog switch IC5.

The center frequency (fo) of the filter is 1/50 the clock frequency. 40±25 kHz is obtained by rectifying the AFT signal of 80±50 kHz (in the CW mode) with Q1 and dividing it in half with IC1. This signal is used as the clock in the same way as with the side-tone generation circuit, and fo is 800±500 Hz and is changed via the PITCH control.

The passband width can be varied with the AF VBT control that is connected between pins 17 and 18 of the main receiver. The passband width can be varied with potentiometer VR1 (10 kΩ) in the sub receiver. It can be adjusted to within ±100 Hz.

Filter IC (MF10CCWM), IC2, used here contains two blocks consisting of an active filter (IC3 [MF5CWM] used in the side tone circuit). Various additional filter configurations can be formed by using external resistors. The center frequency depends on the clock frequency. The filter characteristics and clock frequency can be adjusted and set at will according to the ratio of the external resistor values.

CIRCUIT DESCRIPTION

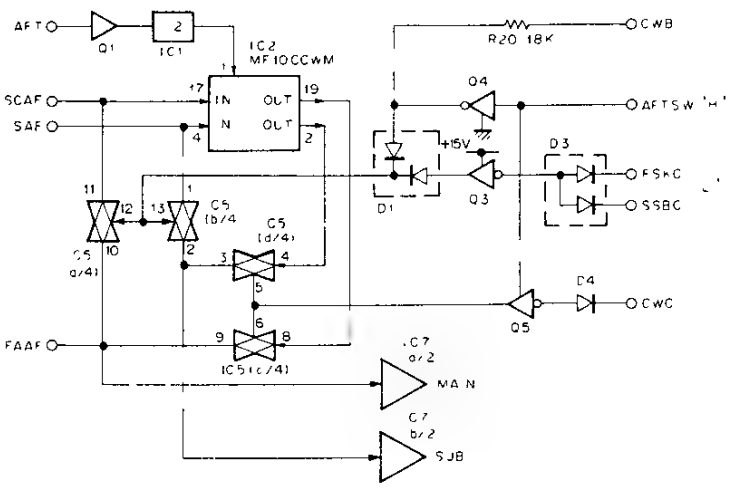
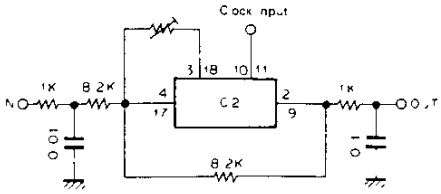


Fig. 11 AF VBT circuit



Terminal function of IC2

2, 19	:	Bandpass filter output
3, 18	:	Connection of resistor for changing Q
4, 17	:	Input
5, 16	:	Analog ground (+5 V)
7, 8	:	Power supply (+10 V)
10, 11	:	Clock input

Fig. 12 Basic configuration of IC2 (MF10CCWM)

- **Auto antenna tuner**

When the AUTO/THRU switch is set to AUTO, ATA goes low, the AUTO/THRU switching relay K1 closes, and the AT is inserted to prepare for tuning.

When the AT TUNE is turned on, ATS goes high and Q10 turns on. If the VSWR is greater than 1.2, Q7 also turns on. A pulse with the appropriate duty cycle for the VSWR is obtained from the pulse control circuit consisting of IC8 and IC7 (a/2) and is used to drive Q5 and turn Q4 on and off. This produces the motor control signal that controls the motor drive ICs (IC4 and IC5). The output from the collector of Q7 is directed to the digital unit as an ' OK signal (low when tuning is completed) indicating the completion of AT tuning. ATS is also fed to the RF unit The transmitter output during tuning is limited to approximately 10 W

The VSWR is calculated from the forward wave and reflected wave voltages VSF and VSR, and detected by filter unit L1 via the microprocessor in the digital unit The VSWR is converted to an analog voltage in the range of 0 to 5 V according to the results of this calculation, and is then applied to the VSWR line.

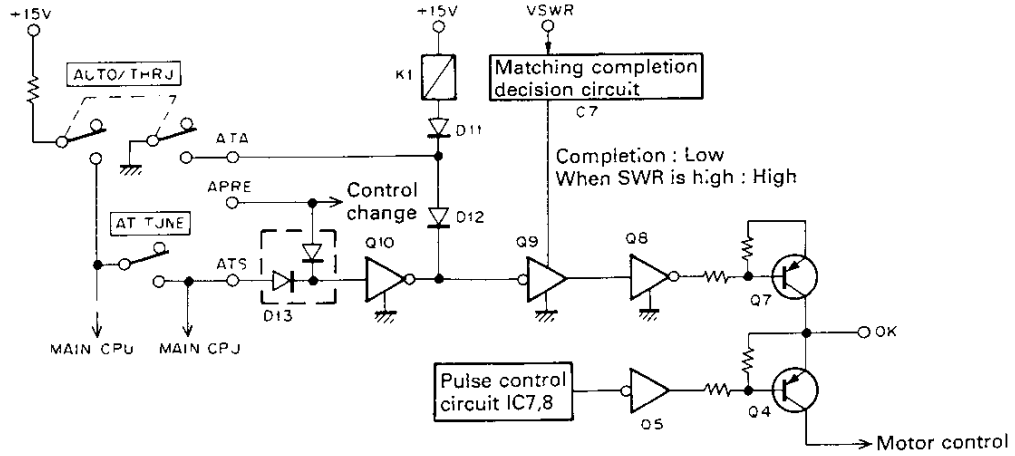


Fig. 13 Auto antenna tuner circuit

CIRCUIT DESCRIPTION

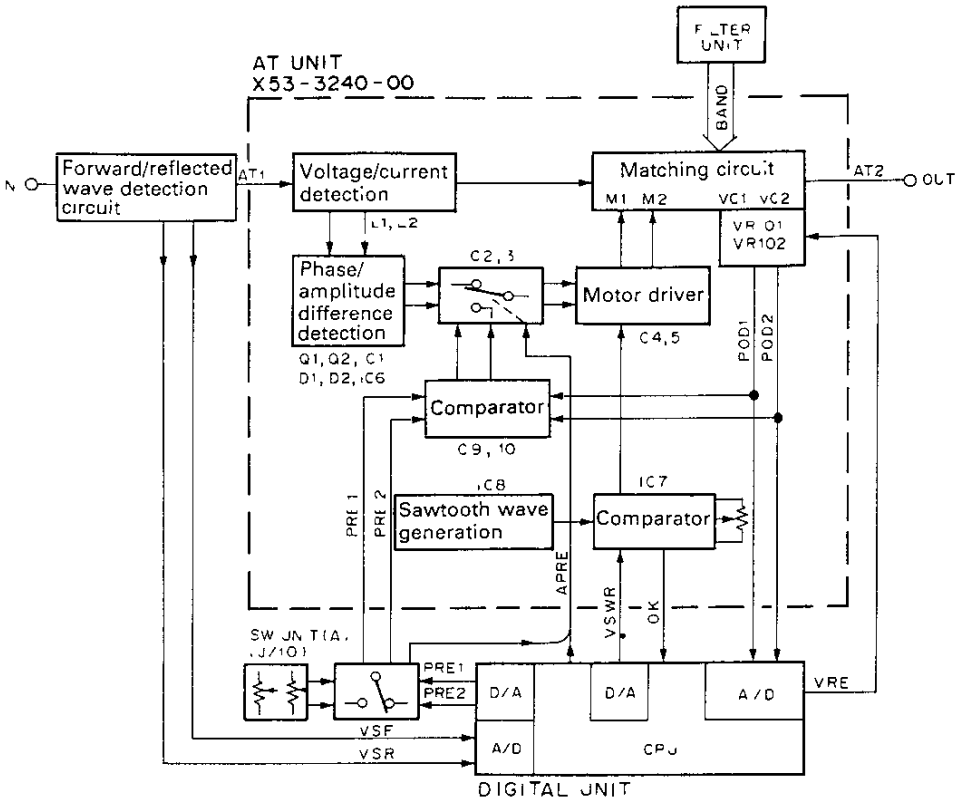


Fig. 14 Auto antenna tuner block diagram

1) Auto tuning mode

The transmitter power from the final unit, via the filter unit, passes through the current/voltage detection transformers L1 and L2, which make use of a toroidal core. The current and voltage components detected here are rectified by a waveform rectification circuit consisting of D4, Q1, and D7, and Q2, and are then phase-compared by IC1 (SN74S74N). The output signals from pins 8 and 9 of IC1 ($\overline{Q}$ and Q) pass through the switch by IC2 (TC4066BP), and are applied to motor drive IC (IC4). Variable capacitor VC1 is turned by motor M1 so that the phase difference of the vo tage and current components decreases

The voltage and current components detected by L1 and L2 are rectified by germanium diodes (1N60) D1 and D2, and are applied to the voltage comparison circu.t .C6 (NJM2903S) as the amplitude component of the signal. The comparator output passes through the switch by IC3 (TC4066BP) Motor M2 is driven by another motor drive .C, .C5 (BA6109U2), wh.ch is used to turn variable capacitor VC2 in the direction that decreases the amplitude difference of the voltage and current components.

Therefore, variable capacitor VC1 adjusts the capacitance of the circuit so that the current and voltage phases match. Variable capacitor VC2 adjusts the resistance of the circuit so that the current and voltage amplitude difference decreases.

The voltage standing wave ratio (VSWR) is calculated by the digital unit from the forward wave and reflected wave that is detected by the filter unit. The VSWR signa., which is 0 to 5 V according to the calculated results, is applied to SWR comparison circuit IC7 (b/2). Voltage corresponding to an SWR of 1.2 is applied to the reference voltage pin (pin 7) of this comparison circuit via the potentiometer When the actual SWR value is 1 2 or higher, the output pin (pin 8) of SWR comparison circuit IC7 (b/2) goes nigh, Q8 turns on, and motor drive vo tage control trans'stor Q7 turns on. Emitter Q4 has approximately 15 V. This voltage is output to the digital unit as a signal indicating tuning (hign) which lights the AT TUNE LED.

The sawtooth wave generated by IC8 (NE555C) is applied to the inverted input pin of IC7 (a/2). The VSWR signal that was described previously is applied to the non-inverted input. Therefore, as the SWR decreases, the output of IC7 (a/2) changes from a continuous waveform to a continuously changing pulse with a re.atively small duty cycle. This waveform drives Q5 and Q4 as the motor drive voltage.

CIRCUIT DESCRIPTION

Through the use of these circuits, when the SWR is 3 : 1 or more, the motor runs at high speed since the duty cycle of the motor drive voltage pulse is 100%. When the SWR is approximately 2 : 1, the duty cycle becomes approximately 50%, and the motor runs at low speed.

The matching circuit used in the tuner is a T-type. The tap position from 1.8 to 30 MHz is controlled by eight relays, K101 to K108

Position detection potentiometers VR101 and VR102 are linked to the rotation axes of variable capacitors VC1 and VC2 with a gear ratio of 1 : 1. Voltages of 0 to 5 V (POD1 and POD2) are generated according to the position of the variable capacitors. This position data is applied to variable capacitor angle control comparators IC9 and IC10, and is used as the reference voltage in the feedback control system which is used for preset tuning and manual tuning. The same signal is also directed to the A/D converter of the digital unit, and used for preset data and to signal the completion of tuning.

The potentiometer used here is not an control that rotates 360 degrees. Since the rotation angle of this potentiometer is limited, the rotation range is from the minimum capacity to the maximum capacity plus a little extra for headroom.

Through this control, like preset tuning, which will be described later, POD1 and POD2 are monitored by the microprocessor. If the lower limit voltage of 0.6 V or the upper limit voltage of 4.2 V is reached, the microprocessor detects that the voltage is close to one of its limits. To return the voltage to the opposite side, the APRE line is switched high. For VC1, if the voltage is close to the lower limit with respect to PRE1, the voltage near the upper limit is output. If the voltage is close to the upper limit with respect to PRE1, the voltage near the lower limit is output. The other variable capacitor VC2 outputs the voltage read by POD2 to PRE2 as it is.

If the variable capacitor voltage exceeds the specified limit, it is returned to the opposite limit. The other variable capacitor remains in the same position.

2) Manual tuning

When AUTO/MANUAL select switch S62 of the switch unit (A) (J/10) is set to MANU, the signal applied to PRE1 and PRE2 is switched to the manual tuning potentiometers VR8 and VR9 via analog switching IC, IC1. Simultaneously a high signal is applied to the APRE line, causing Q3 of the AT unit to turn on, and the control switches of IC2 and IC3 are switched to PRE1 and PRE2. Potentiometers VR8 and VR9 generate approximately 0.4 to 4.5 V, which is applied to another input of each variable capacitor angle control comparator, IC9 and IC10, and is compared with the position data. Feedback control is performed so that the voltages match.

3) Preset tuning

When auto or manual tuning ends (the OK signal changes from high to low), and the voltage of POD1 and POD2 is placed in memory as preset data for that band by the microprocessor. When the band is changed, even if tuning is performed in another band, VSWR and APRE go high, and preset tuning is performed by the feedback control system. If the microprocessor detects that PRE1 and PRE2 match POD1 and POD2, the VSWR returns to its original value (the last SWR value calculated), and APRE goes low. The auto control system becomes effective. (The initial preset data when the microprocessor is reset includes standard data for a 50Ω load on each band.)

CIRCUIT DESCRIPTION

- **Standby control and timing**

Standby control and timing are performed by the control unit (X53-3230-00). The input control signals include the following ;

SS Standby switch Active low.
$\overline{SS}$: Inverted SS. Base for producing each timing voltage.
CSS : Standby signal to the microprocessor Active low.
ATS . Standby signal from ANT TUNER. Active high.
ESS : Standby signal from the personal computer control Active high.
KEY . Keying signal from the keyer. Active low.
KSW . Signal indicating whether a key is inserted in the key jack. GND: Key is inserted
TXI : Transmission disable signal from the microprocessor. Low (Disabled.
VOXQ : Standby signal from VOX. Active high.

The output control signals include the following ;

CTXB : Signal that generates TXB (transmission 15 V). Active high.
TXB : Transmission 15 V
KYB : Keying signal generated by keying. Active high.
CKY : Keying signal with timing. Active high.
RXB : 15 V in receive mode. Same timing as inverted TXB.
RBC Receive control signal with timing. Active low.

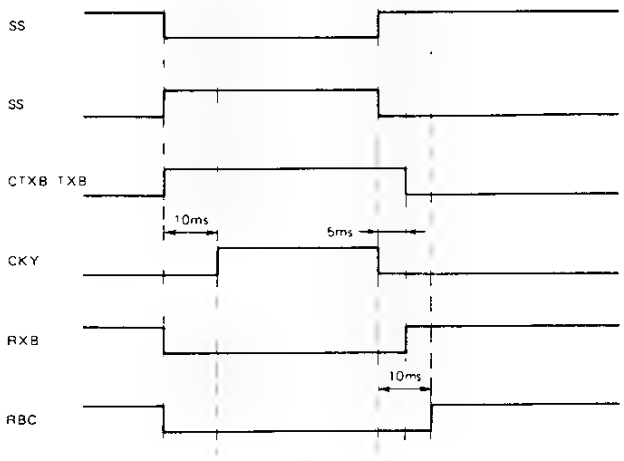


Fig. 15 Basic timing chart for standby

1) Manual standby (other than CW)

- **RX to TX switching**

Occurs when the standby switch is pressed and the SS line is grounded. If pin 5 (TXI) of the CWT module (X59-3660-00) is high transmit is possible, Q203 and Q202 in the module turn on and 15 V is applied to pin 2 from the collector of Q202 Voltage $\overline{SS}$ passes through pin 5 of IC13 and D16 and is applied to pin 2 of the TRX module (X59-3680-00) as CTXB This signal turns on Q153 and Q152 and generates TXB from pin 5. The collector of Q152 goes high, Q154 turns on, Q155 and Q151 turn off, and RXB from collector of Q151 turns off

- **CKY generation**

$\overline{SS}$ forces pin 2 of C6 high, and triggers pin 4, the A input pin, of C10 one-shot multi-vibrator. The $\overline{Q}$ output is low for 10 ms and then goes high. As a result of this pin 3 of IC6 goes low 10 ms after the standby switch is pressed. The signal is then applied to pin 11 of IC5, and the inverter output is felt on pin 10.

The CWB line applied to pin 13 of IC5 is high in the CW mode and is low in other modes. This causes the inverter output on pin 12 to always be high.

Pin 5 of C4 is high during full break-in, turning the analog switch on. Pin 13 of IC4 is high during semi-break-in, turning the analog switch on CKY is output 10 ms after SS with the same timing from pins 2 and 3 of IC4 regardless of semi-break-in or full break-in status

The CKY signal is generated, and a bias is applied to the second transmit mixer. Meanwhile, the signal is applied to pin 4 of the ALC module (X59-3700-00) via D17, passed through integration circuit Q251 for waveform shaping, and matched with the negative ALC signal to produce the FET gate bias for the transmitter IF.

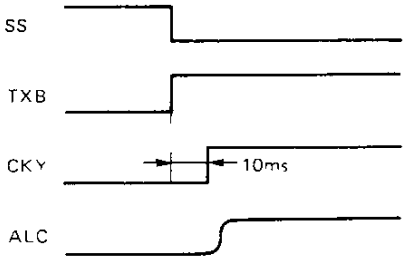


Fig. 16 CKY generation

CIRCUIT DESCRIPTION

· **TX to RX switching**

When the standby switch is turned off, Q203 and Q202 of the CWT module (X59-3660-00) are turned off, and the SS signal changes from high to low. D16's anode changes from high to low 5 ms after the SS signal changes since there is a 5-ms time constant circuit composed of R43, R44, and C37 attached to for the output of pin 2 of IC13.

Therefore, the cathode of D15 CTXB switches from transmit to receive , and TXB goes low 5 ms after the standby switch is turned off.

When TXB goes low, Q154 of the TRX module (X59-3680-00) turns off, Q155 and Q151 turn on, and RXB rises.

· **CKY down**

When $\overline{SS}$ goes low, pin 2 of IC6 goes low, pin 3 goes high, pin 10 of IC5 goes low, and the CKY output goes low. Thus, the CKY signal changes from high to low when the standby switch is turned off.

The ALC waveform output from the ALC module rises according to the time constant of the integration circuit.

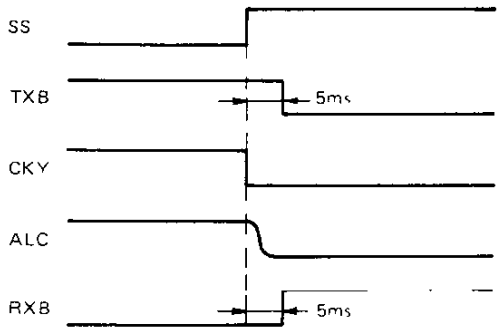


Fig. 17 CKY down

· **RBC generation**

When CTXB line changes from high to low, pins 9 and 11 of IC13 go low, and the NAND gate output at pin 4 changes from high to low 5 ms after CTXB goes low; i.e., RXB rises according to the time constant circuit provided ahead of pin 8 of the inverter output.

The RBC signal is connected to the base of an NPN transistor. This transistor switches the 455-kHz receive IF circuit to ground. The receiver operates only when RBC is low.

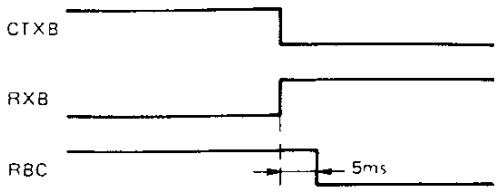


Fig. 18 RBC generation

· **PLL data and transmit/receive timing signal**

As explained earlier, the SS signal is used at the beginning of each operation. PLL data is switched, and diode switch and analog switch settings are changed to assure stable transmission and reception 10 ms after the SS line is grounded, until the last CKY timing signal for transmit has been generated, and for 5 ms after the RXB line rises, until the RBC line goes low

2) Full break-in timing

· **Generation of the TXB signal at key down**

When the key is inserted into the key jack, pin 9 of the CWT module (X59-3660-00) is grounded, and the emitter of Q208 is grounded.

When the key is down, Q201, Q208, Q206, and Q207 turn on, causing the output of pin 6, KYB, to go high. The KYB signal passes through D11, D23, pins 1 and 2 of IC3, and D22, and forces the $\overline{SS}$ line high. Q7 is turned on via D10, and the CSS line is grounded to notify the microprocessor of the start of transmission.

When the transmit disable signal TXI is low in order to disable transmit, Q205 and Q204 of the CWT module (X59-3660-00) are turned on, and the CWB line is grounded. Q206 and Q207 are turned off, and the KYB line goes low. The $\overline{SS}$ line remains low during this period.

When the $\overline{SS}$ line again becomes high, the CTXB line goes high via D16; therefore, Q153 and Q152 of the TRX module (X59-3680-00) are turned on in order to generate the TXB signal. Meanwhile, Q154, Q155, and Q151 are turned off, and the RXB line switches low.

CIRCUIT DESCRIPTION

· CKY generation

When the $\overline{SS}$ line goes high, pin 2 of IC6 also goes high, and the $\overline{Q}$ output of IC10 goes high after a 10 ms delay. The output of pin 3 of IC6 goes low 10 ms after that.

The output of pin 10 of IC5 goes high and pin 5 of the analog switch of IC4 goes high when in FULL break-in operation. Pins 4 and 3 conduct, CKY goes high, and the second transmit mixer of the IF unit is keyed.

The CKY output enters the ALC module (X59-3700-00) via D15, passes through the integration circuit Q251 for waveform shaping, and is matched with the negative signal of ALC to produce the FET gate bias of the transmit IF.

· Generation of RXB when the key is up

When the key is up, the SS line goes low, and the anode of D16 also goes low. Meanwhile, Q7 turns off, and the CSS line goes high to notify the microprocessor of the start of reception.

Since there is a 5-ms time constant circuit composed of R43, R44, and C37 for the output of pin 2 of IC13, the output of pin 4 of IC13 goes from high to low 5 ms after the $\overline{SS}$ line switches. Therefore, CTXB goes low 5 ms after the key goes up, and with a similar delay for the TXB line.

When TXB fails, Q154 of the TRX module (X59-3680-00) is turned off, and Q155 and Q151 turn on, causing RXB to rise.

· CKY down

When the key is up, KYB and $\overline{SS}$ go low, pin 3 of the NAND gate of IC6 goes high, and thus the CKY line goes low.

· RBC generation

The RBC signal is generated in the same way as for manual standby. The RBC changes from high to low 5 ms after RXB rises when the key is released. The receiver operates only when RBC is low.

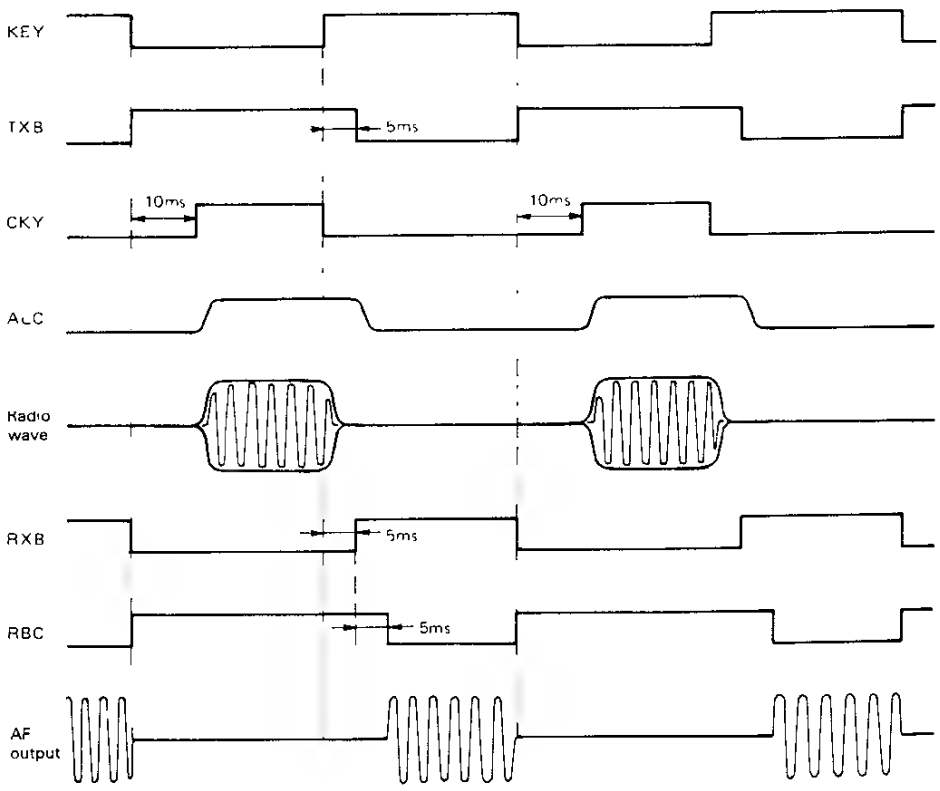


Fig. 19 Timing chart for full break-in

CIRCUIT DESCRIPTION

3) Timing for semi-break-in operation

· Generation of the TXB signal when the key is depressed

When the key is down, the $\overline{SS}$ line goes high in similar to the manner described for full break-in.

During semi-break-in operation, pin 5 of analog switch IC3 goes high, and pins 4 and 3 conduct. Q7 is turned on via D26, pins 4 and 3 of IC3, and D10 from the $\overline{SS}$ line; and CSS is grounded to notify the microprocessor of the start of transmission

TXB is generated from CTXB via D16 from SS.

· CKY and transmission hold circuit

The KYB signal produced by depressing the key triggers the A input pin of one-shot multi-vibrator IC10, and the Q output is high for a period of time.

Since pin 5 of analog switch IC3 is high, pins 4 and 3 conduct. Q7 is turned on via D10, pins 4 and 3 of IC3, and D10 from the Q output; and the CSS line is grounded. CSS is held low for the time determined by a time constant of the one-shot multi-vibrator, or the time constant for semi-break-in.

The KYB signal, having passed through D11, enters pin 11 of C1, passes through the time constant circuit composed of R51, C38, and R52, and is applied to pin 1 of IC2's NAND gate from the IC1 inverter D21.

Pin 2 ($\overline{SS}$) of IC6 goes high through D27 and pins 4 and 3 of IC3 while the Q output of IC10 is high. The $\overline{SS}$ line is held high while IC10 is retriggered by the keying signal.

Therefore, pin 2 of IC6's NAND gate is high. The A input of the IC10 one-shot multi goes high unless $\overline{SS}$ changes 10 ms after $\overline{SS}$ is triggered for the first time $\overline{Q}$ goes high. Pin 1 of IC6 goes high, and pin 10 of IC5 and pin 2 of IC2 go high.

Therefore, the output of pin 3 of IC2, the signal keyed by KYB is generated from pin 2 of analog switch IC4 with a 5 ms delay time and becomes the CKY signal. When the hold time of the IC10 one-shot multivibrator has elapsed after the key is released, the Q pin goes low, and $\overline{SS}$ goes low, returning the unit to receive

4) VOX operation

When one-shot multi-vibrator IC9 is triggered by the output of the VOX module (X59-1080-01) of the AF unit (X49-3020-00), the Q line output goes high and is connected to the control unit (X53-3230-00) by a harness. Q8 is turned on through pins 8 and 9 of analog switch IC3 from connector CN4 VOXQ pin of the control unit, and the SS line is grounded. Subsequent operations are the same as for manual standby.

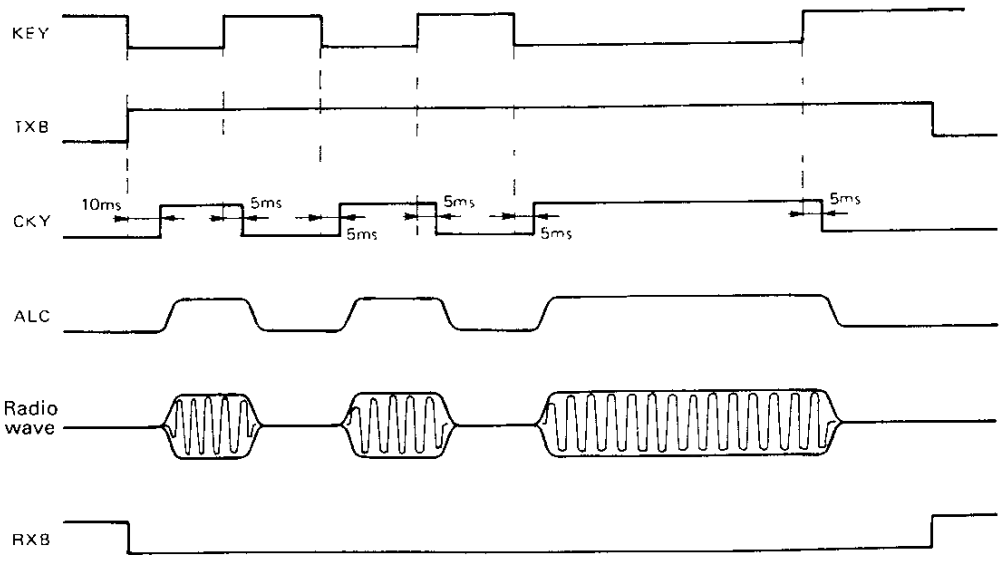


Fig. 20 Semi-break-in timing chart

CIRCUIT DESCRIPTION

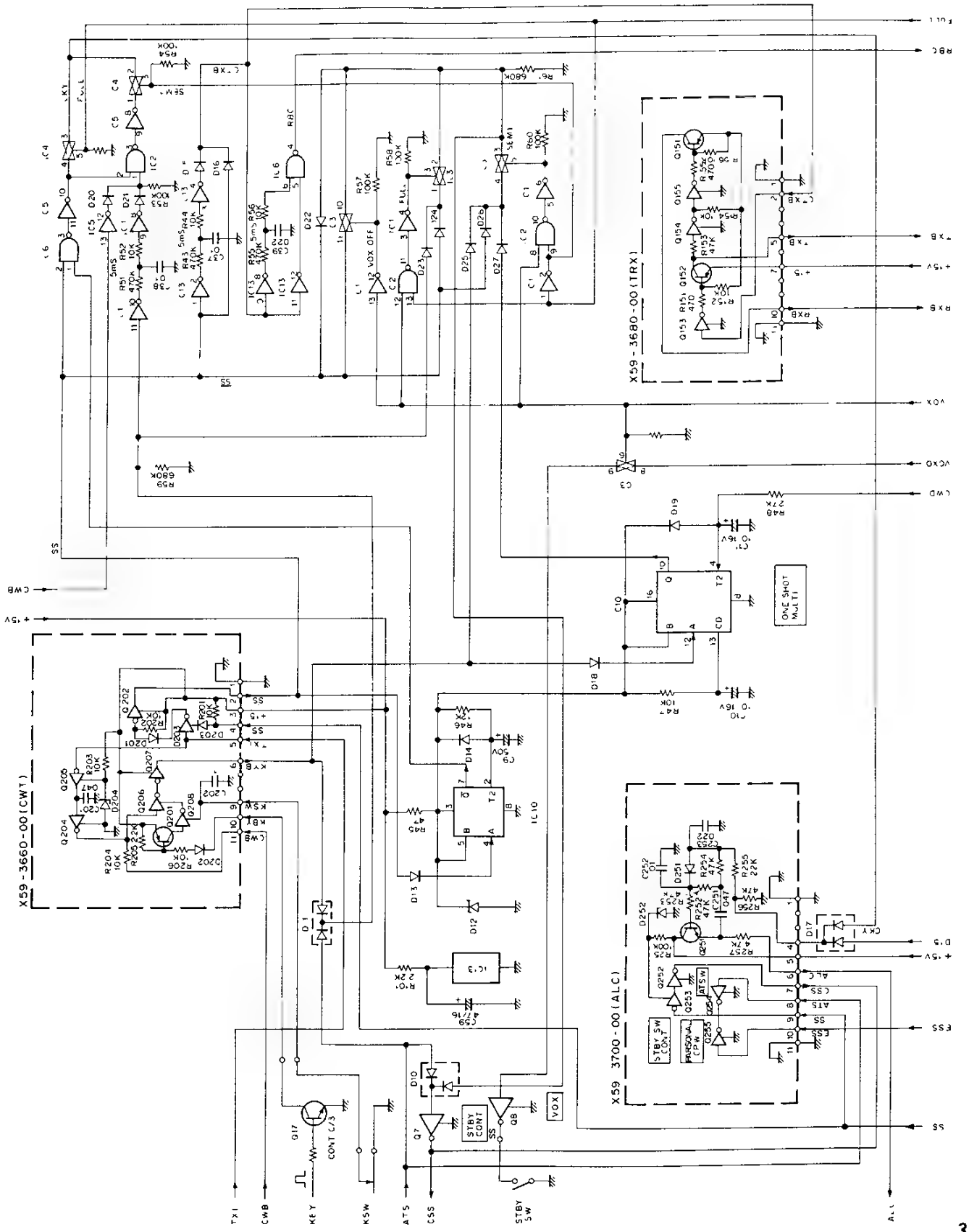


Fig. 21 Standby circuit

CIRCUIT DESCRIPTION

- **Electronic keyer circuit**

The TS-950 contains an electronic keyer circuit so that an electronic key, external electronic keyer or a squeeze paddle can be connected to the CW KEY jack on the rear panel. IC14 on the control unit (X53-3230-00) generates the CW Waveform, and is the major element of the electronic keyer circuit with variable speed and variable weight functions.

When the electronic key switch on the rear panel is off, the keyer circuit functions as a buffer and outputs the signal input from the dot pin to the standby circuit as it is. When the electronic key switch on the rear panel is on, the circuit outputs dot and dash codes according to the operation of the paddle connected to the CW KEY jack.

1) Variable weight function

Electronic keyer microprocessor IC14 has a variable weight function. For normal CW code, the dot/dash/space ratio is fixed at 1 : 3 . 1. This electronic keyer can vary the ratio of dot to dash.

When the auto switch is off, four ratios can be set according to manual weight data WT0 and WT1.

By default, Auto (OFF, WT0, WT1 = OFF, and Short point /Long point /Space is 1 /3 /1.

WT1	WT0	Short point/Long point/Space
OFF	OFF	1 . 3 1
OFF	ON	1 . 2 8 1
ON	OFF	1 3 2 1
ON	ON	1 . 3 4 1

Table 8

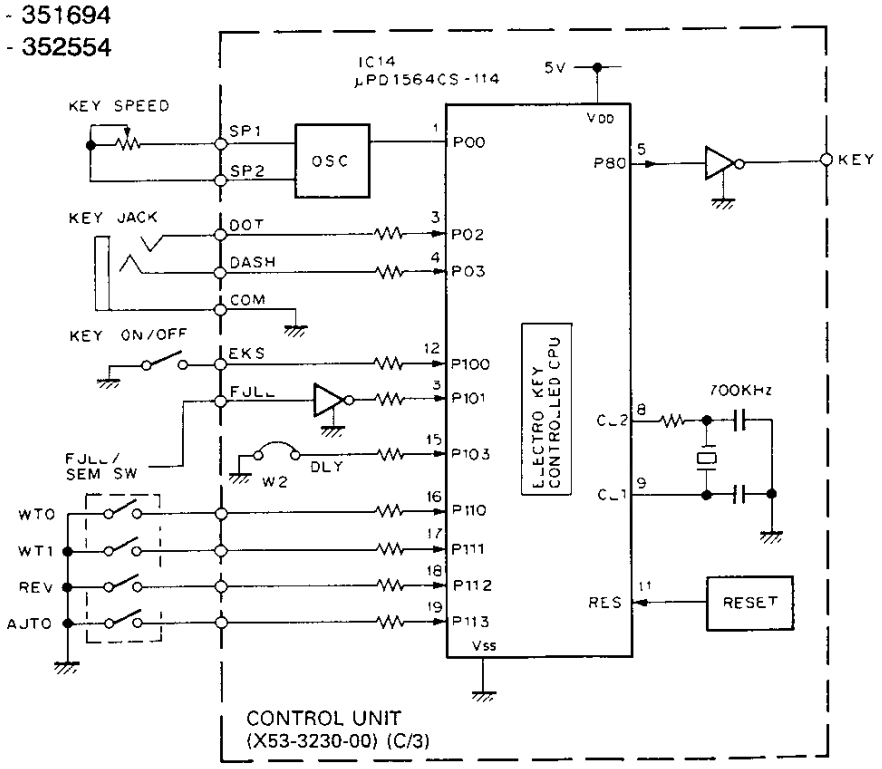
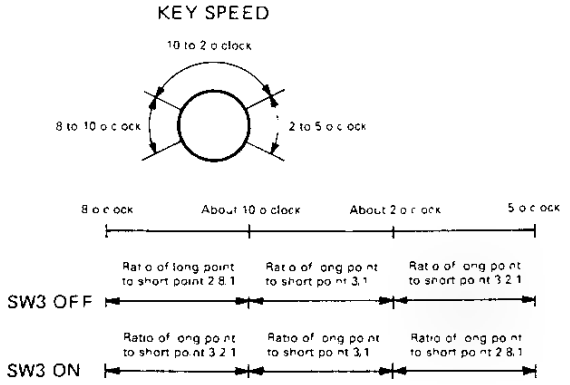
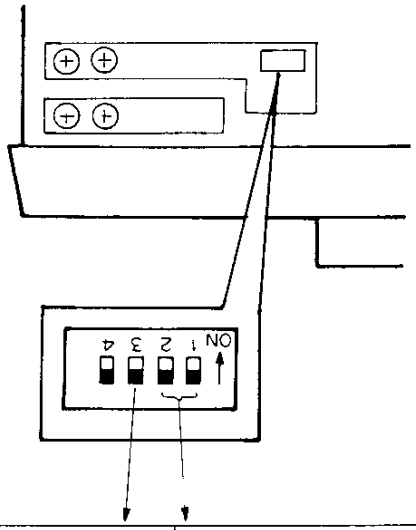


Fig. 22 Block diagram of electronic keyer

CIRCUIT DESCRIPTION

When the auto switch is turned on, the ratio of long point to short point is interlocked with the KEY SPEED VR and can be set automatically. As the keying speed increases, the speed is varied so that the long point is lengthened or shortened. This is selected by the REV switch.





SW4 ON		SW4 OFF		
SW3	Automatic setting of long point to short point	SW2	SW1	Fixed ratio of long point to short point
OFF	As the speed increases, the long point is lengthened	OFF	OFF	3 : 1
		OFF	ON	2.8 : 1
ON	As the speed increases, the long point is shortened	ON	OFF	3.2 : 1
		ON	ON	3.4 : 1

Fig. 23 Variable weight function by DIP switches

2) Full break-in correction function

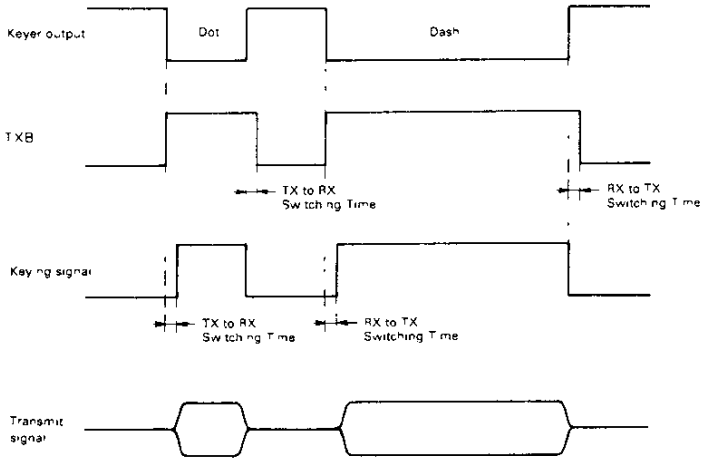
When full break-in operation is performed, the transmit time of the CW signal is shortened by the influence of the time constant of transmit/receive switching, even if keying is performed.

The electronic keyer has a full break-in correction function, which works automatically when the FULL/SEMI switch is set to FULL.

The full break-in correction function lengthens the CW waveform by 1/5 maintaining the dot time, shortens the space by 1/5 the dot time, and changes the duty cycle, while maintaining the lengths of the code and space constant. Thus the transmission signal is generated by taking the transmit/receive switching time into account.

The full break-in correction is effective for the weight-varied code as well.

Radio signal without full break-in correction



Radio signal with full break-in correction

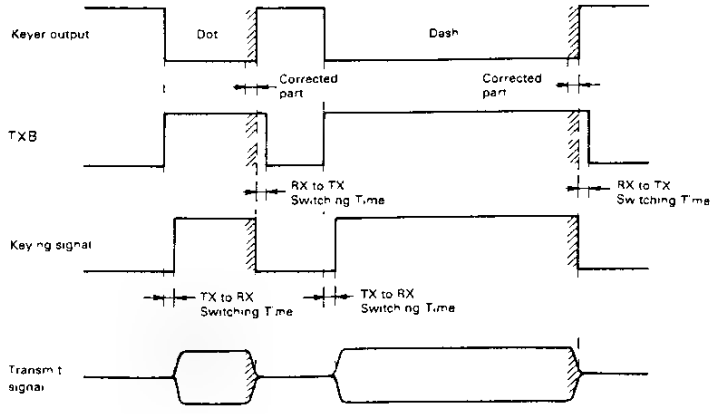


Fig. 24 Full break-in correction function timing chart

CIRCUIT DESCRIPTION

Digital control circuit

The TS-950 digital control circuit has a multiple chip configuration centered around IC1 (μPD78C10G), and consists of a 32K ROM (MBM27C256A), an 8K RAM (TC5564APL), and an I/O port (MB89363B, CXD1095Q). This circuit controls about 40 different inputs and about 70 different outputs.

A large fluorescent display tube and sub CPU dedicated for the display are used so that the display can be controlled via serial data.

- **Encoder circuit**

Ultra-small magnetic rotary encoders are used as the main and sub encoders. The Mon click encoders that were used in the TS-680 and have gained users favor are installed. The encoder pulse is applied to gate array LZ92K37, and read via the CPU bus. The gate array is selected by the Y3 or Y4 lines. Encoder data is output to D0 to D7 by selecting encoders CK1, CK2 or CK3, and CK4 by A8 (gate array A0), and making RD active. IC12 is used to rectify the waveform

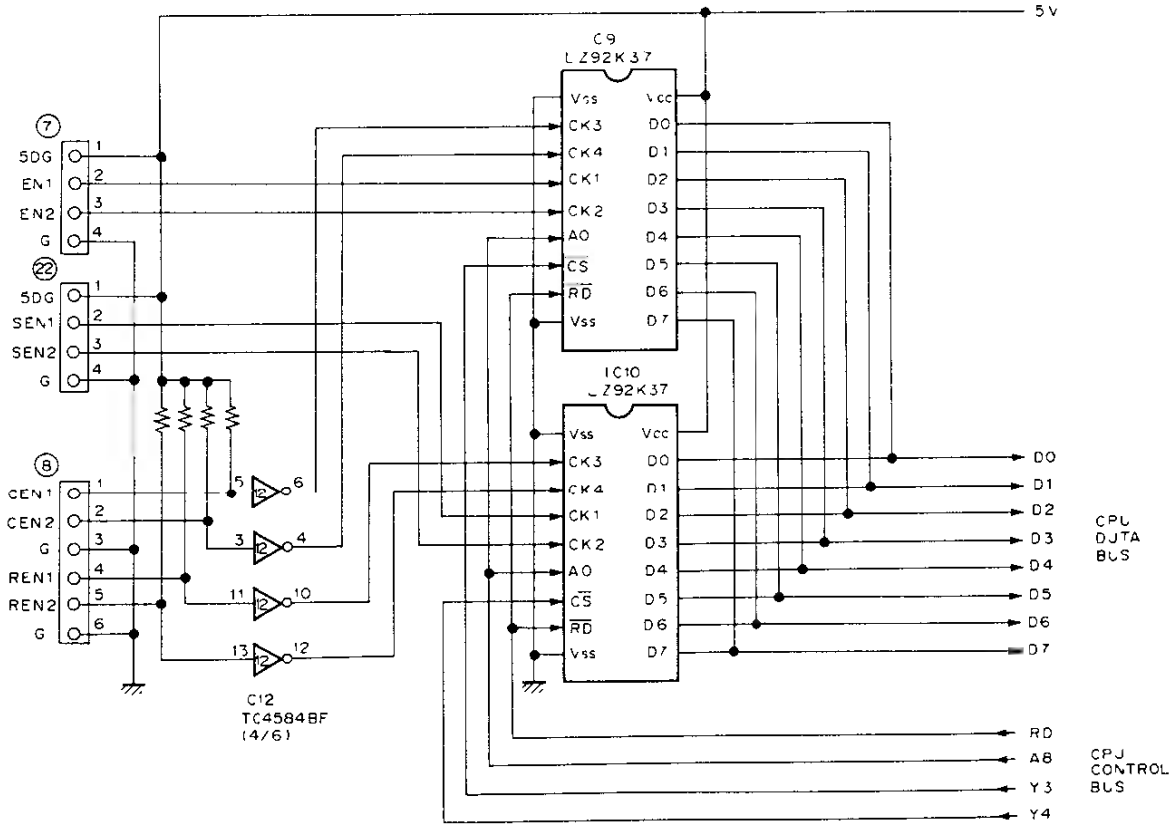


Fig. 25 Encoder circuit

CIRCUIT DESCRIPTION

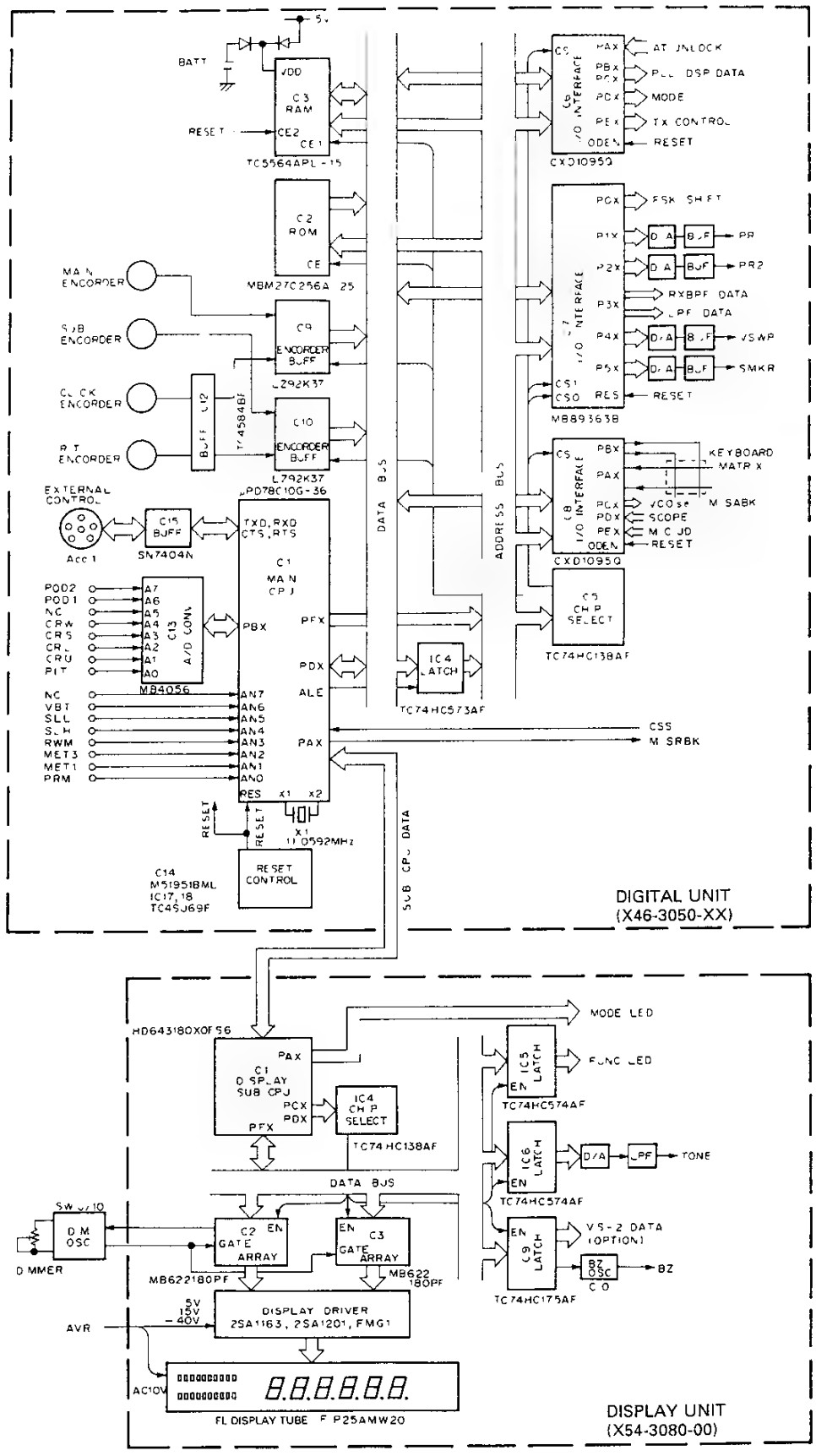


Fig. 26 Digital control block diagram

CIRCUIT DESCRIPTION

- **System reset**

The power supply voltage is detected by the dedicated reset IC M51951BML (IC14). If the voltage is found to be low, the IC outputs a RESET signal to the CPU and I/O to stop operation, and back up the RAM.

When the power supply voltage becomes normal (including power on), the reset is released, the CPU and I/O are initialized after the time constant set by R5 and C18, and operation resumes.

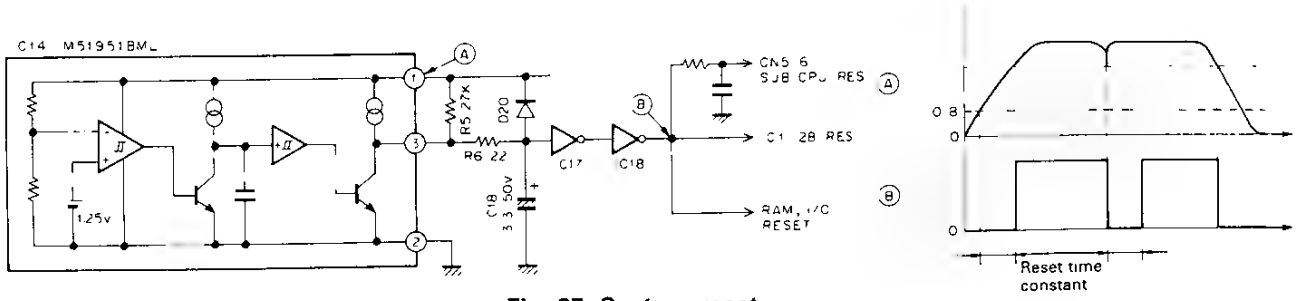


Fig. 27 System reset

- **Address control**

Since PD0 to PD7 of the main CPU have multiplexed address and data signals, the address signal is separated from the data signal by latching the address signal using the ALE signal provided by IC4 (TC74HC573AF).

PF0 to PF7 become the high-order data (A8 to A15) of the address. The address signal of A12 to A15 is used as a chip select signal for each IC by address decoder IC5 (TC74HC138AF).

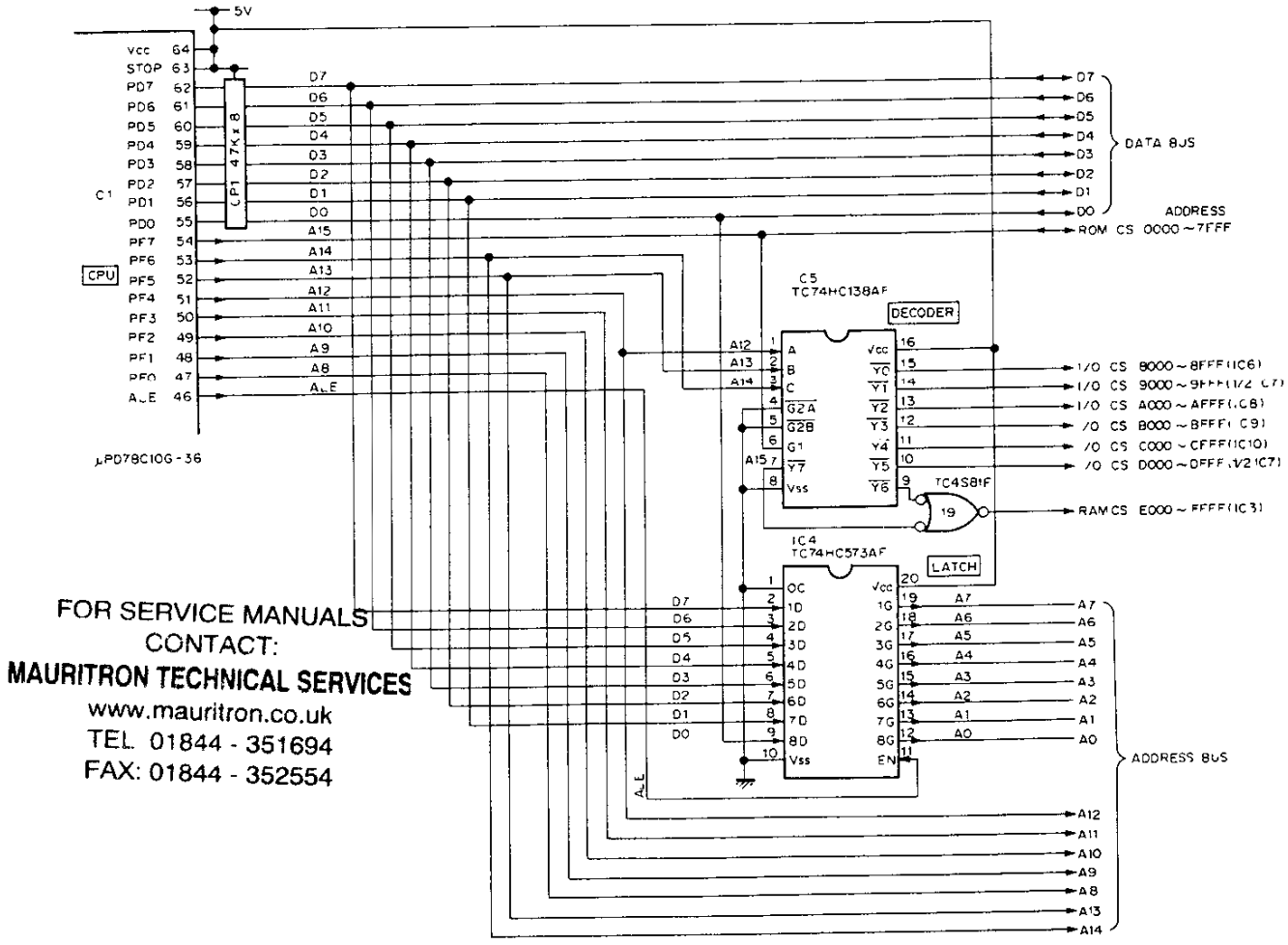


Fig. 28 Separation of address and data, address decoder circuit

CIRCUIT DESCRIPTION

- **Analog signal input**

The main CPU (μPD78C10G-36) incorporates an 8-channel A/D converter, and in addition, has makes use of IC13 (MB4056) for entering 14-channel analog signals. Incoming analog signals are converted to digital values, which are used as digital data.

IC1 : μPD78C10G-36 (CPU)

Port name	Signal name	Description
AN0	PRM	Processor meter voltage
AN1	MET1	S/RF meter voltage
AN2	MET3	ALC/IC meter voltage
AN3	RWM	Reflected wave meter voltage
AN4	SLH	Slope tune high cut amount voltage
AN5	SLL	Slope tune low cut amount voltage
AN6	VBT	VBT amount voltage
AN7	–	Not used

IC13 : MB4056 (A/D converter)

Port name	Signal name	Description
A0	P.T	CW pitch variable voltage
A1	CRU	USB carrier point variable voltage
A2	CRL	LSB carrier point variable voltage
A3	CRS	Sub receiver carrier point variable voltage
A4	CRW	Carrier variable voltage
A5	–	Not used
A6	POD1	AT variable capacitor 1 position voltage
A7	POD2	AT variable capacitor 2 position voltage

Table 9 Analog signal input

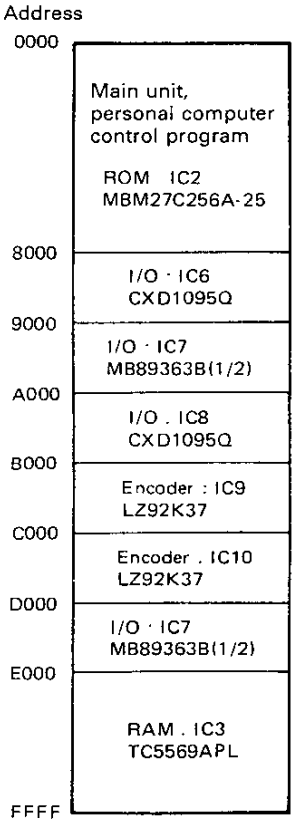


Fig. 29 Memory map

- **Display**

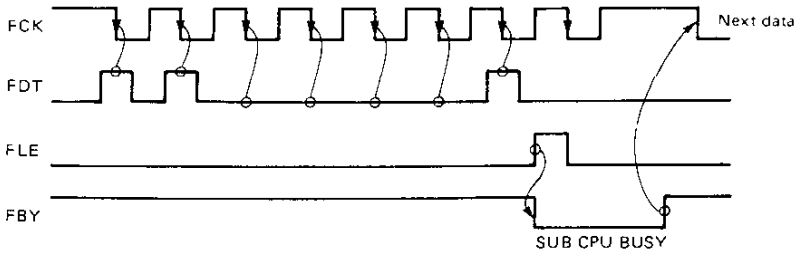
Since the TS-950 uses a large fluorescent display tube combined with a meter, a new sub CPU for the display drive has been developed. The sub CPU is located on the display unit (X54-3080-00), and is controlled by serial commands from the main CPU.

The work load on the main CPU can be decreased by making the main CPU send display data and control data to the sub CPU for display as a serial command, since the sub CPU lights the fluorescent display dynamically.

The sub CPU lights the fluorescent display dynamically according to the command data from the main CPU. Since there are 24 grids, including the meter and sub reception frequency, and the display scan speed is not sufficient to control the grids by itself, the grids are divided and scanned at high speed to avoid flickering. The sub CPU not only drives the display, but also performs other processing, such as repeater subtone synthesis, beeper tone, LED display, and optional VS-2 audio synthesis.

The power required to light the display is supplied by the power supply unit.

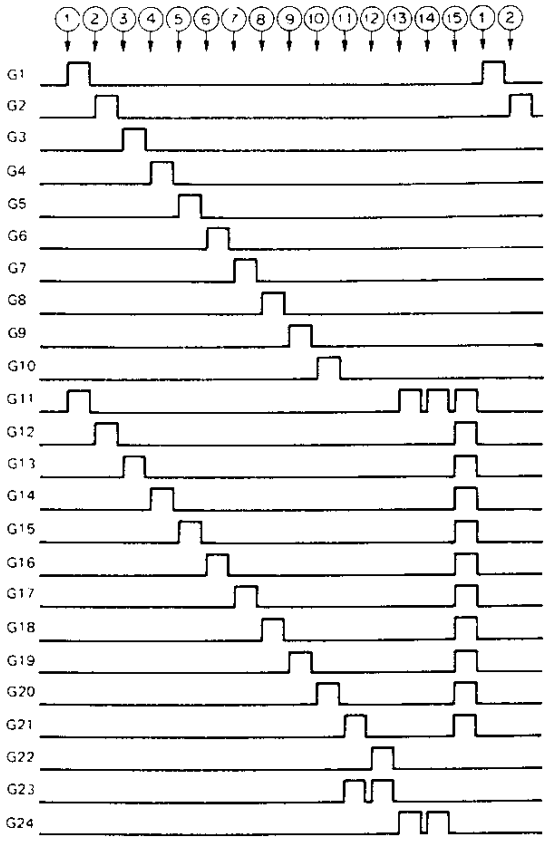
The dimmer functions by varying the duty cycle of the gate array output. A display enable signal is output from the LH pin (CN5-3) of the display unit each time one segment is displayed. This signal changes the duty cycle continuously with the one-shot multivibrator contained in NE555P of switch unit (A) (J/10), and changes the brightness through the gate array.



Serial data is sent from CN5- 8 FCK to CN5-9 FDT.
CN5-7 FLE : The command and number of data items are listed in the command table.
CN5-6 FBY : LSB is the first data, and the FLE (⎍) pulse is required for each byte.
When FBY is high after FLE (⎍), the next byte can be transferred.

Fig. 30 Sub CPU data transfer

CIRCUIT DESCRIPTION



(1)	G1	: TX VFO 10Hz,	SUB VFO 10Hz	G11 . RIT 10Hzg
(2)	G2	TX VFO 100Hz,	SUB VFO 100Hz	G12 : RIT 100Hz
(3)	G3	: TX VFO 1kHz,	SUB VFO 1kHz	G13 · RIT 1kHz
(4)	G4	· TX VFO 10kHz,	SUB VFO 10kHz	G14 "kHz ' display
(5)	G5	· TX VFO 100kHz,	SUB VFO 100kHz	G15 : MAIN VFO 10Hz
(6)	G6	: TX VFO 1MHz,	SUB VFO 1MHz	G16 . MAIN VFO 100Hz
(7)	G7	· TX VFO 10MHz,	SUB VFO 10MHz	G17 . MAIN VFO 1kHz
(8)	G8	: A, B, M function		G18 MAIN VFO 10kHz
(9)	G9	. Units dig t in Mch		G19 · MAIN VFO 100kHz
(10)	G10	: Tens digit .n Mch		G20 : MAIN VFO 1MHz
(11)	G23	: Upper meter		G21 · MAIN VFO 10MHz
(12)	G23	. Upper meter		G22 : Filter se.ect
(13)	G24	· Lower meter		One of G11 to G21 (Analog scale red po nter)
(14)	G24	Lower meter		One of G11 to G21 (Analog scale red po nter)
(15)		No d'sp ay		All G11 to G21 (Analog scale)
(1)	Repeat from (1)			

In (11) to (14), the meters (upper and lower) and analog scale red pointer light twice to increase the intensity.
There is a blanking t'me (whole display off) when the display is switched during each scan. The lighting period is approxi-matery 520 µs (Display illuminated: approximately 470 µs; blanking: approximately 50 µs)

Fig. 31 Timing chart for display lighting (grid only)

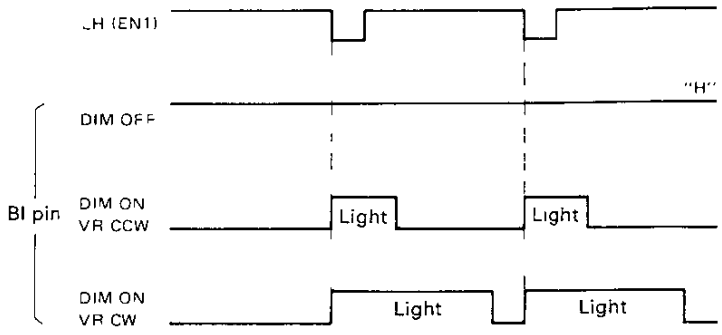


Fig. 32 LH and BI signals for dimmer

CIRCUIT DESCRIPTION

- **PLL data**

The TS-950 has 10 PLLs (11 PLLs when the DSP-10 is installed).

The main CPU provides PLL data to these PLLs according to the displayed frequency.

Main VFO PLL's 3
Sub VFO PLLs 2
Local oscillator PLL's for frequency conversion 3
Main carrier oscillator PLL 1
Sub carrier oscillator PLL 1
DSP sampling frequency PLL 1
(TS-950SD type or units with DSP-10)

Since the data of these PLLs may be fixed, it is given only once when the power is switched on.

As the main encoder changes, VCO1, VCO2, and VCO3 change.

As the mode changes, VCO4, VCO0, and VCO9 change

As the sub receiver frequency changes, VCO7 and VCO8 change.

VCO5 and VCO6 change via data from the slope tune and VBT

Ten PLL ICs, excluding the DSP, provide unlock data signals If one of the PLLs should unlock, the display changes to '.' (decimal points only) to indicate that the PLL is unlocked Unlockdata from each PLL s output to pin 8, A0, as UL data, so it can be checked

Loop			VCO No.	IC	Ref. frequency/ Ref. division ratio	Variable division ratio	VCO oscillator frequency	Input terminal	Unlock signal
MAIN	LO1	Up	VCO1	AF unit (X49-3020-00) IC11 CXD1225M	500k/20	76~136	73 06~103MHz	FMI (11 pin)	A0 (8 pin) 'H' Unlock
		Middle	VCO2	PLL unit (X50-3100-00) IC2 CXD7925B	100k/100	366~317	49 5~44 5MHz	FMI (11 pin)	A0 (8 pin) 'H' Unlock
		Down	VCO3	PLL unit (X50-3100-00) IC3 CXD7925B	2k, 5000	29000~28001	58~56MHz	FMI (11 pin)	A0 (8 pin) H' Unlock
	LO2	2nd local oscillator	VCO0	AF unit (X49-3020-00) IC13 CXD1225M	FM mode 5k/2000 Other than FM mode 20k/500	FM mode 12844 Other than FM mode 3211	Fixed at 64 22MHz	FMI (11 pin)	A0 (8 pin) "H" Unlock
	LO3	3rd local oscillator	VCO6	CAR unit (X50-3110-XX) C3 CXD7925B	2k/5000	Center 35750	Approx 71 5MHz	FMI (11 pin)	A0 (8 pin) 'H' Unlock
	LO4	4th local oscillator	VCO5	CAR unit (X50-3110-XX) C1 CXD7925B	2k/5000	Center 17750	Approx 35 5MHz	FMI (11 pin)	A0 (8 pin) 'H' Unlock
	CAR		VCO9	CAR unit (X50-3110-XX) IC9 CXD7925B	2k/5000	Center 29750	Approx 59 5MHz	FMI (11 pin)	A0 (8 pin) H" Unlock
			VCO4	CAR unit (X50-3110-XX) IC6 CXD7925B	2k/5000	Center 34750	Approx 69 5MHz	FMI (11 pin)	A0 (8 pin) H' Unlock
SUB	LO	Up	VCO7	PLL unit (X50-3100-00) IC17 CXD7925B	2k/5000	185~3185	40 065~70 055MHz	AM (13 pin)	A0 (8 pin) A0 (8 pin)
		Down	VCO8	PLL unit (X50-3100-00) IC10 CXD7925B	2k/5000	54500~53501	109~107MHz	FMI (11 pin)	A0 (8 pin) 'H' Unlock
	CAR	MAIN CAR shared	VCO4 shared	CAR unit (X50-3110-XX) IC6 CXD7925B	2k/5000	Center 34750	Approx 69 5MHz	FMI (11 pin)	A0 (8 pin) H' Unlock
DSP	DSP		VCO11	DSP unit (X53-3260-00) IC34 CXD7925B	54 054k/185	728	Fixed at 39 351MHz	FM (11 pin)	

The input frequency for the reference frequency of the PLL IC is 10MHz

Table 10

CIRCUIT DESCRIPTION

- **Key scan**

The PA port and PB port of .C8 form a keyboard matrix. A scan signal (a negative pu se) is output from the PB port. One column corresponding to the PA port s seiected, and the state of that sw tch is read. When the switch at the intersection of the matr x is pressed, the PA port bit goes low. Thus, which switch is pressed can be detected. Keys are software-debounced.

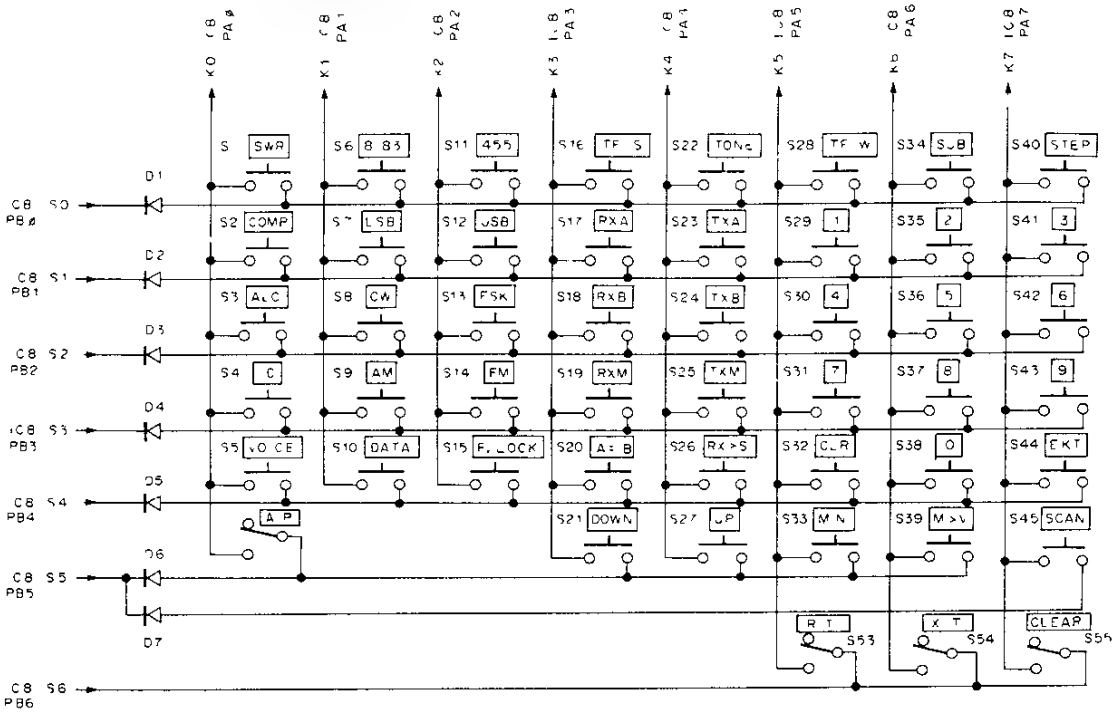


Fig. 33 Keyboard matrix

- **Bandscope signal**

The SM-230 Station monitor can be connected to the TS-950. The sub receiver frequency can be displayed as an intensity marker point on the SM-230 tube surface because of the simultaneous two band receive function of the main unit.

The digital unit outputs the difference between the main frequency and the sub frequency to the SM-230. The TS-950 receives bandscope scan width data from the SM-230, and outputs the sub reception frequency point at the position specified by the sweep width when the center of the tube surface is the main receive frequency. It then displays it by the intensity marker on the SM-230.

The resolution for each scan width is divided and sent by 100 divisions to the right and 100 divisions to the left from the center of the tube surface (a total of 200 divisions).

±25kHz : 50 kHz/200 = 250 Hz resolution

The main CPU controls the main and sub receiver frequency, and calculates the direction of the sub receiver frequency as compared to the main frequency (right or left from the center of the tube surface) and the difference between them. It is processed by the D/A converter, buffered, and output as a digital value according to the range and resolution. It is output to the SCOPE pin.

SMKC is the ON/OFF signal for sub reception. This signal turns the intensity marker on or off so that there is no intensity point when the sub receiver is off. The output is grounded by the open collector when the sub receiver is turned on.

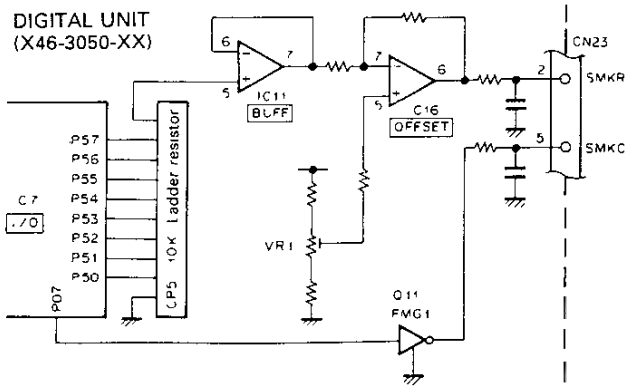


Fig. 34 Bandscope signal

CIRCUIT DESCRIPTION

- **AT control**

The AT band data is decoded by LPF data, and the AT tap is always switched. When the main unit begins transmission, the VSWR is calculated from the values of power and RWM (reverse power), and the VSWR signal is applied to the AT unit to display on the SWR meter and judge whether the AT tuning has been completed.

1) When AT auto switch is on

The AT unit controls the relay so that signals pass through the matching circuit, and places the AT control system in standby.

The main CPU takes the variable capacitor position set for the band from preset data, and drives it to that position. Even if the band changes, the CPU drives the capacitors to the preset position stored in memory, and waits for the next operation.

2) AT TUNE on by AT auto

When both AT Auto and AT Tune are pressed at the same time, the mode is changed to CW, the filter is set to 8.83 MHz 2.7 kHz, 455 kHz 2.7 kHz for transmission, and the AT tune mode is set.

Since transmit is initiated by AT TUNE, the main CPU outputs the VSWR signal and waits until the tune completion signal (OK signal) arrives from the AT unit. The AT unit enters the auto tune mode, and start tuning automatically.

The rotation angle of the variable capacitor is limited by the variable resistor connected to it. Therefore, if the variable capacitor approaches the mechanical limit of the variable resistor, the motor rotation is reversed towards the preset side from the detector side, in the same way as for the preset setting position, and the variable capacitor position is moved to the other end of the variable resistor range, and returned to the detector side. The main CPU continues tuning, and waits until a tuning completion signal arrives.

When manual presetting is performed, the motor rotation is switched from the detector side to the preset side, and the variable capacitor position is moved by potentiometers, R-tune and X-tune at the upper right of the set.

3) When the tuning is completed

When the AT unit outputs a tune completion signal (OK=Low), the main CPU updates preset data, making that variable capacitor position the new preset value.

4) When AT tuning is off

When AT Auto or AT Tune is released, the AT Tune mode is released. The mode and filter are returned to their values before AT tuning was initiated.

- **Receive bandpass filter selection (RF unit)**

The RF BPF signal (RB0 to RB3) from the digital unit is buffered by Q6 and Q7 of the digital unit, and is then forwarded to the RF unit. The RF unit obtains RF BPF data divided into 15 from 4 bits using two sets of BCD-to-Decimal decoders. Band data is given in the list. RF BPF data is 4-bit parallel data.

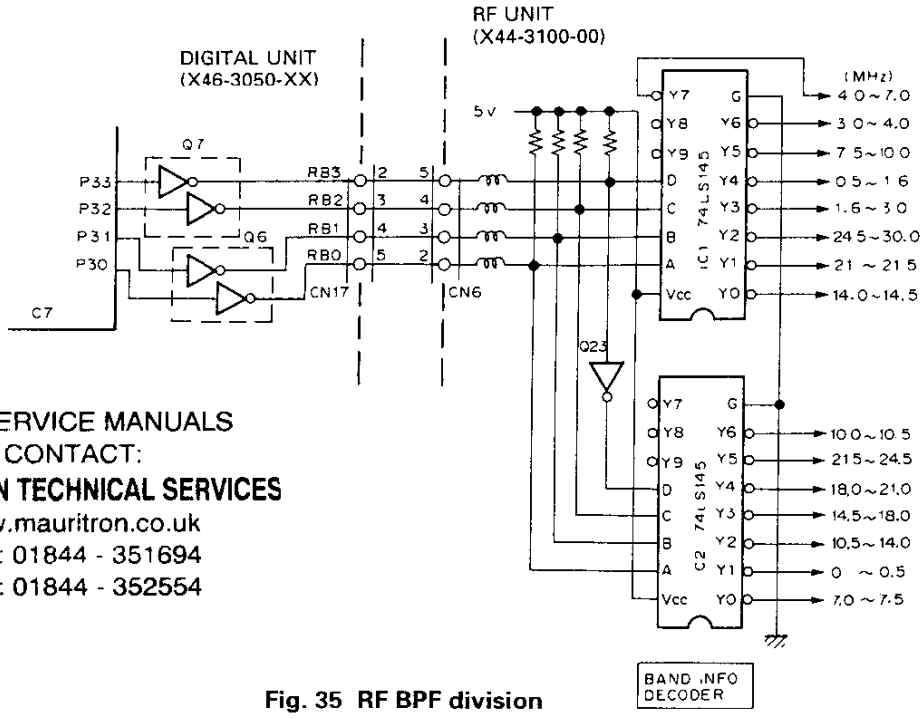


Fig. 35 RF BPF division

CIRCUIT DESCRIPTION

- **IF filter switching**
  (455 kHz : Signal unit, 8.83 MHz : IF unit)

The F filter switching signal from the digital unit is sent to the signal unit as 10-bit serial data. In the signal unit, serial-to-parallel converter IC8 (TC9174F) converts the serial data to parallel data to select the 8.83-MHz filter and the 455 kHz IF filter. IF filter select data is stored in memory as a portion of the VFO data for each mode.

The optional IF filter data is set by S1 of the digital unit, so that filter positions without filters are not selected.

The 8.83 MHz 270-Hz filter has no dedicated connection pointed is mounted in the same place as the 8.83 MHz 500 Hz filter position. 500 Hz and 270 Hz are recognized by the D.P switch, but they cannot be used at the same time.

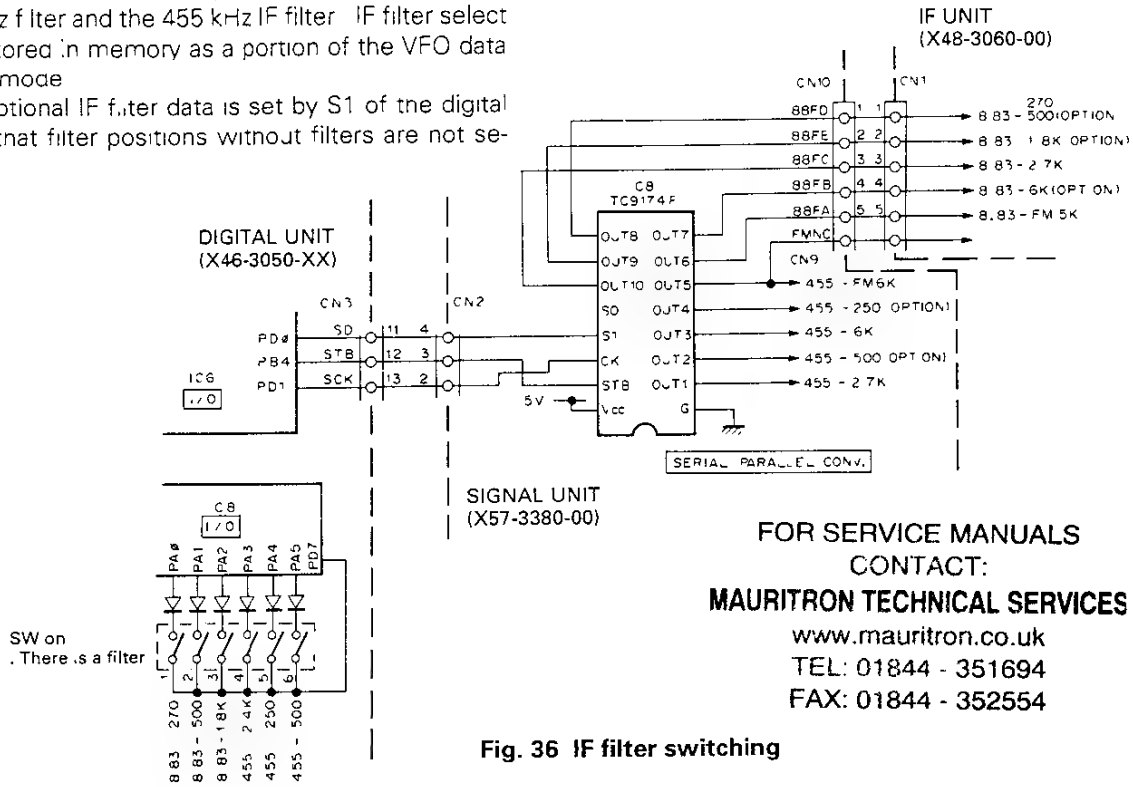


Fig. 36 IF filter switching

- **Transmit LPF, AT band data (LPF unit, AT unit)**

Transmitter system band data (LP0 to LP3) from the digital unit is buffered by Q8 and Q9 of the digital unit. The data is then forwarded to the filter unit. The select signal divided and decoded by the filter unit selects TX LPF in the filter unit and the AT BAND of the AT unit. For the appropriate band data, see the accompanying list.

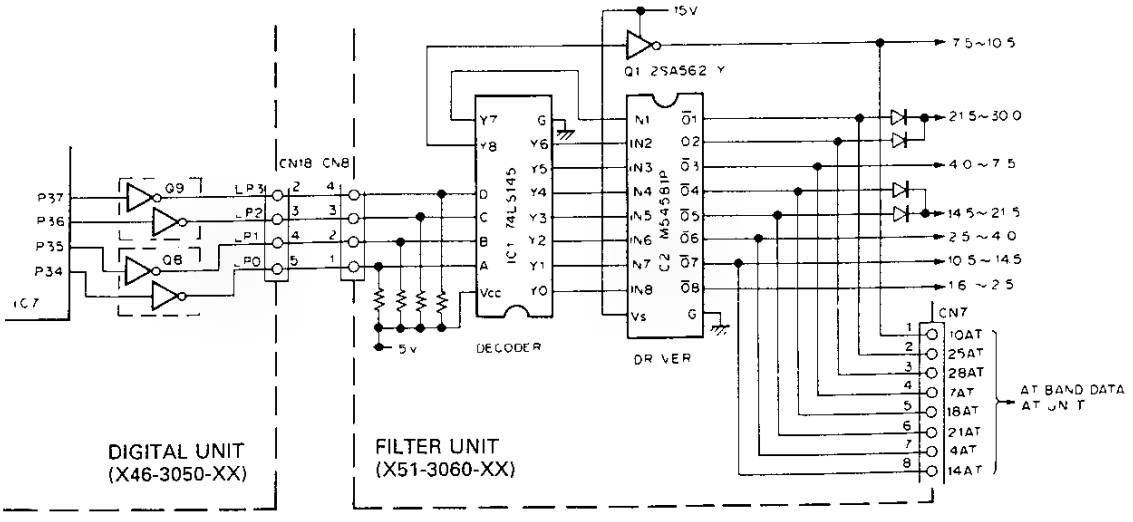


Fig. 37 Transmit LPF, AT band data

CIRCUIT DESCRIPTION

- **List of band data**

  Note: VB, RB, and LP are the logic signals on the output pins of the I/O port.

Frequency (MHz)	VCO0 N	VB VCO-B				RB RX BPF				LP LPF			
		VBD	VBC	VBB	VBA	RB3	RB2	RB1	RB0	LP3	LP2	LP1	LP1
0 01000 ~ 0 49999	76	0	0	0	1	0	1	1	0	1	1	1	1
0 50000 ~ 0 99999	77	0	0	0	1	1	0	1	1	1	1	1	1
1 00000 ~ 1 49999	78	0	0	0	1	1	0	1	1	1	1	1	1
1 50000 ~ 1 62000	79	0	0	0	1	1	0	1	1	1	1	1	1
1 62001 ~ 1 99999	79	0	0	0	1	1	1	0	0	1	1	1	1
2 00000 ~ 2 4999	80	0	0	0	1	1	1	0	0	1	1	0	1
2 50000 ~ 2 99999	81	0	0	0	1	1	1	0	0	1	1	0	1
3 00000 ~ 3 49999	82	0	0	0	1	1	0	0	1	1	1	0	1
3 50000 ~ 3 99999	83	0	0	0	1	1	0	0	1	1	1	0	1
4 00000 ~ 4 49999	84	0	0	0	1	1	0	0	0	1	0	1	0
4 50000 ~ 4 99999	85	0	0	0	1	1	0	0	0	1	0	1	0
5 00000 ~ 5 49999	86	0	0	0	1	1	0	0	0	1	0	1	0
5 50000 ~ 5 99999	87	0	0	0	1	1	0	0	0	1	0	1	0
6 00000 ~ 6 49999	88	0	0	0	1	1	0	0	0	1	0	1	0
6 50000 ~ 6 99999	89	0	0	0	1	1	0	0	0	1	0	1	0
7 00000 ~ 7 49999	90	0	0	0	1	0	1	1	1	1	0	1	0
7 50000 ~ 7 99999	91	0	0	1	0	1	0	1	0	0	1	1	1
8 00000 ~ 8 49999	92	0	0	1	0	1	0	1	0	0	1	1	1
8 50000 ~ 8 99999	93	0	0	1	0	1	0	1	0	0	1	1	1
9 00000 ~ 9 49999	94	0	0	1	0	1	0	1	0	0	1	1	1
9 50000 ~ 9 99999	95	0	0	1	0	1	0	1	0	0	1	1	1
10 00000 ~ 10 49999	96	0	0	1	0	0	0	0	1	0	1	1	1
10 50000 ~ 10 99999	97	0	0	1	0	0	1	0	1	1	1	1	0
11 00000 ~ 11 49999	98	0	0	1	0	0	1	0	1	1	1	1	0
11 50000 ~ 11 99999	99	0	0	1	0	0	1	0	1	1	1	1	0
12 00000 ~ 12 49999	100	0	0	1	0	0	1	0	1	1	1	1	0
12 50000 ~ 12 99999	101	0	0	1	0	0	1	0	1	1	1	1	0
13 00000 ~ 13 49999	102	0	0	1	0	0	1	0	1	1	1	1	0
13 50000 ~ 13 99999	103	0	0	1	0	0	1	0	1	1	1	1	0
14 00000 ~ 14 49999	104	0	0	1	0	1	1	1	1	1	1	1	0
14 50000 ~ 14 99999	105	0	1	0	0	0	1	0	0	1	0	1	1
15 00000 ~ 15 49999	106	0	1	0	0	0	1	0	0	1	0	1	1
15 50000 ~ 15 99999	107	0	1	0	0	0	1	0	0	1	0	1	1
16 00000 ~ 16 49999	108	0	1	0	0	0	1	0	0	1	0	1	1
16 50000 ~ 16 99999	109	0	1	0	0	0	1	0	0	1	0	1	1
17 00000 ~ 17 49999	110	0	1	0	0	0	1	0	0	1	0	1	1
17 50000 ~ 17 99999	111	0	1	0	0	0	1	0	0	1	0	1	1
18 00000 ~ 18 49999	112	0	1	0	0	0	0	1	1	1	0	1	1
18 50000 ~ 18 99999	113	0	1	0	0	0	0	1	1	1	1	0	0
19 00000 ~ 19 49999	114	0	1	0	0	0	0	1	1	1	1	0	0
19 50000 ~ 19 99999	115	0	1	0	0	0	0	1	1	1	1	0	0
20 00000 ~ 20 49999	116	0	1	0	0	0	0	1	1	1	1	0	0
20 50000 ~ 20 99999	117	0	1	0	0	0	0	1	1	1	1	0	0
21 00000 ~ 21 49999	118	0	1	0	0	1	1	1	0	1	1	0	0
21 50000 ~ 21 49999	119	1	0	0	0	0	0	1	0	1	0	0	0
22 00000 ~ 22 49999	120	1	0	0	0	0	0	1	0	1	0	0	0
22 50000 ~ 22 99999	121	1	0	0	0	0	0	1	0	1	0	0	0
23 00000 ~ 23 49999	122	1	0	0	0	0	0	1	0	1	0	0	0
23.50000 ~ 23 99999	123	1	0	0	0	0	0	1	0	1	0	0	0
24 00000 ~ 24.49999	124	1	0	0	0	0	0	1	0	1	0	0	0
24 50000 ~ 24 99999	125	1	0	0	0	1	1	0	1	1	0	0	0
25 00000 ~ 25 49999	126	1	0	0	0	1	1	0	1	1	0	0	1
25 50000 ~ 25 99999	127	1	0	0	0	1	1	0	1	1	0	0	1
26 00000 ~ 26 49999	128	1	0	0	0	1	1	0	1	1	0	0	1
26 50000 ~ 26 99999	129	1	0	0	0	1	1	0	1	1	0	0	1
27 00000 ~ 27 49999	130	1	0	0	0	1	1	0	1	1	0	0	1
27 50000 ~ 27 99999	131	1	0	0	0	1	1	0	1	1	0	0	1
28 00000 ~ 28 49999	132	1	0	0	0	1	1	0	1	1	0	0	1
28 50000 ~ 28 99999	133	1	0	0	0	1	1	0	1	1	0	0	1
29 00000 ~ 29 49999	134	1	0	0	0	1	1	0	1	1	0	0	1
29 50000 ~ 29 99999	135	1	0	0	0	1	1	0	1	1	0	0	1
30 00000	136	1	0	0	0	1	1	0	1	1	0	0	1

CIRCUIT DESCRIPTION

• Functions of IC pins

1) MAIN CPU : μPD78C10G-36 (Digital unit IC1)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port	PA0	1	FDT	Fluorescent display tube, LED display data	O	
	PA1	2	FCK	Fluorescent display tube, LED display data clock	O	
	PA2	3	FLE	Fluorescent display tube, LED display data enable	O	
	PA3	4	FBY	Fluorescent display tube, LED display data busy	I	"L" Busy, "H" Sub CPU is ready to receive
	PA4	5	MRBK	Main RF blanking	O	"H" Blanking
	PA5	6	SRBK	Sub RF blanking	O	"H" Blanking
	PA6	7	–	Not used		
	PA7	8	CSS	Transmit/receive control signal	I	"H" Reception, "L" Transmission
B port	PB0~PB2	9~11	C0~C2	External A/D (MB4056) channel data	O	
	PB3	12	CS	External A/D chip select	O	"L" Chip select
	PB4	13	CLK	External A/D data clock	O	
	PB5,PB6	14,15	–	Not used		
	PB7	16	DO	External A/D data	I	
C port	PC0	17	TXD	Personal computer interface transmit signal	O	TTL level
	PC1	18	RXD	Personal computer interface receive signal	I	TTL level
	PC2	19	CTS	Personal computer interface transmission enable signal	I	TTL level
	PC3	20	–	Not used		
	PC4	21	RTS	Personal computer interface reception enable signal	O	TTL level
	PC5~PC7	22~24	–	Not used		
A/D port	AN7	41	–	Not used		
	AN6	40	VBT	A/D channel 6, VBT input	I	
	AN5	39	SLL	A/D channel 5, slope tune low-cut VR input	I	
	AN4	38	SLH	A/D channel 4, slope tune high-cut VR input	I	
	AN3	37	RWM	A/D channel 3, reflected wave voltage input	I	
	AN2	36	MET3	A/D channel 2, ALC/Ic meter voltage input	I	
	AN1	35	MET1	A/D channel 1, Signal/RF meter voltage input	I	
	AN0	34	PRM	A/D channel 0, Processor meter voltage input	I	
Control signal	PD0~PD7	55~62	AD0~AD7	CPU address/data multiplex bus	I/O	
	PF0~PF7	47~54	A8~A15	CPU high-order address bus	O	
	ALE	46	ALE	Address/data separation signal	O	
	RD,WR	44,45	RD,WR	Read/Write signal	O	
	NMI	25	NMI	Nonmaskable interrupt	I	Always "H"
	M1,M0	27,29	M1,M0	External memory mode	I	Always "H"
	AVcc	43	AVcc	Power supply for A/D converter	I	
	AVREF	42	AVREF	Reference power supply for A/D converter	I	5V
	AVss	33	AVss	Ground for A/D converter		
	X1,X2	30,31	X1,X2	CPU clock crystal pin	I	
	RES	28	RES	CPU reset signal	I	"L" : Reset
	STOP	63	STOP	CPU stop signal	I	Always "H"

2) Extended I/O : CXD1095Q (Digital unit IC6)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port	PA0	54	OK	AT tune operation signal	I	"H" : In operation
	PA1	55	MNS	AT manual/auto switch signal	I	"L" : Auto, "H" : Manual
	PA2	56	ATA	AT ON (auto)/ OFF (through) switch signal	I	"L" : ON, "H" : OFF
	PA3	59	ATS	AT tune start switch signal	I	"L" : Stop, "H" : Start
	PA4	60	UL1	Unlock signal 1		"L" : Unlock
	PA5	61	UL2	Unlock signal 2		
	PA6	62	UL3	Unlock signal 3	I	
	PA7	63	DB	DSP installation signal	I	"H" : DSP installation

CIRCUIT DESCRIPTION

	Port name	Pin No.	Name	Function	I/O	Remarks
B port	PB0	64	MDA	DSP control data	O	For DSP and PLL in DSP
	PB1	3	MCK	DSP control data clock	O	For DSP and PLL in DSP
	PB2	4	MEN	DSP control data enable	O	For DSP
	PB3	5	MLE	DSP control data enable	O	For PLL in DSP
	PB4	6	STB	Serial-to-parallel conversion IC data enable	O	TC9174F
	PB5	7	HIPC	AIP on/off signal	O	"L" OFF, "H" ON
	PB6	8	PCK	PLL control data clock	O	
	PB7	9	PDA	PLL control data	O	
C port	PC0	11	PLE7	PLL control data enable 7	O	For VCO7
	PC1	12	PLE6	PLL control data enable 6	O	For VCO6
	PC2	13	PLE8	PLL control data enable 8	O	For VCO8
	PC3	14	PLE5	PLL control data enable 5	O	For VCO5
	PC4	15	PLE3	PLL control data enable 3	O	For VCO3
	PC5	16	PLE9	PLL control data enable 9	O	For VCO9
	PC6	17	PLE2	PLL control data enable 2	O	For VCO2
	PC7	18	PLE4	PLL control data enable 4	O	For VCO4
D port	PD0	20	SD	Serial-to-parallel conversion IC data	O	TC9174F
	PD1	21	CK	Serial-to-parallel conversion IC data clock	O	
	PD2	22	DATC	DATA mode	O	"H", Mode is selected
	PD3	23	FSKC	FSK mode	O	
	PD4	24	AMC	AM mode	O	
	PD5	27	CWC	CW mode	O	
	PD6	28	FMC	FM mode	O	
	PD7	29	SSBC	SSB mode	O	
E port	PE0	49	ALMS	METER select signal	O	"L" ALC meter, "H" ALC meter
	PE1	50	–	Not used		
	PE2	52	TXI	Transmit disable signal	O	"H" Transmit disable
	PE3	53	ESS	Personal computer interface transmission request signal	O	"H" Transmission request
Control signal	D0~D7	30~32,35~39	D0~D7	Data bus	I/O	
	RD,WR	44,43	RD,WR	Read/Write signal	I	
	A0~A2	46~48	A0~A2	Port select signal		
	ODEN	41	ODEN	Output disable signal		When reset, all ports become input ports
	CS	45	CS	Chip select signal		

3) Extended I/O : MB89363B (Digital unit IC7)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port (P0X)	P00	28	SLE1	FSK control shift data 1	O	
	P01	27	SLE2	FSK control shift data 2	O	
	P02	26	SLE3	FSK control shift data 3	O	
	P03	25	APRE	ATU manual/auto signal	O	"L" Manual, "H" Auto
	P04~P06	23~21	–	Not used		
	P07	20	SMKC	SM-230 sub marker control signal	O	"L" OFF "H" ON
B port (P1X)	P10~P17	44~51	PRE1	ATU variable capacitor 1 preset D/A data	O	
C port (P2X)	P20~P27	34~40,43	PRE2	ATU variable capacitor 2 preset D/A data	O	
D port (P3X)	P30~P33	77~80	RB0~RB3	Receive band data	O	
	P34~P37	1~4	LP0~LP3	Transmit band data	O	
E port (P4X)	P40~P47	54~61	VSWR	ATU SWR D/A data	O	
F port (P5X)	P50~P57	62,65~71	SMKR	SM-230 sub-marker D/A data	O	

CIRCUIT DESCRIPTION

	Port name	Pin No.	Name	Function	I/O	Remarks
Control	DB0~DB7	12~19	DB0~DB7	Data bus	I/O	
s gnal	RD,WR	76,5	RD,WR	Read/Wr te s gnal	I	
	RES	6	RES	Reset s gna		'L' Reset
	A0,A1	31,32	A0,A1	Port select signa		
	CS0	29	CS0	Ch p se ect signal		' _' P0X~P2X s select
	CS1	75	CS1	Chip select signal	I	'L' P3X~P5X is select

4) Extended I/O : CXD1095Q (Digital unit IC8)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port	PA0~PA7	54~63	K0~K7	Key input	I	
B port	PB0~PB7	64,3~9	S0~S7	Key matrix select s gna	O	
C port	PC0	11	SABK	Sub AF blanking	O	'H B ank ng
	PC1	12	MABK	Main AF blank ng	O	'H B ank ng
	PC2	13	PLE0	PL_ control data enable 0	O	For VCO0
	PC3	14	PLE1	PLL control data enable 1	O	For VCO1
	PC4~PC7	15~18	VBA~VBD	PLL band data	O	
D port	PD0	20	RG1	SM-230 sweep width data 1		
	PD1	21	RG0	SM-230 sweep widtn data 0	I	
	PD2~PD6	22~28	–	Not used		
	PD7	29	FRS	Filter DIP switch select s gnal	O	
E port	PE0	49	MOS	Transm ssion mon tor sw tch signa		L' OFF 'H" ON
	PE1	50	–	Not used		
	PE2	52	MD	MIC down switch signal	O	' _ ON
	PE3	53	MU	MIC up switch s gna	O	_ ON
Control	D0~D7	30~32,35~39	D0~D7	Data bus	I/O	
signa.	RD,WR	44,43	RD,WR	Read/Write signa		
	A0~A2	46~48	A0~A2	Port select signal		
	ODEN	41	ODEN	Output disable signa		When reset, a ports become input ports
	CS	45	CS	Chip select s gnal		

5) Extended I/O (A/D converter) : MB4056 (Digital unit IC13)

	Port name	Pin No.	Name	Function	I/O	Remarks
A/D	A0	2	PIT	A/D channel 0, pitch VR input		
port	A1	3	CRJ	A/D channel 1, carrier JSB VR input		
	A2	4	CR_	A/D channel 2, carrier _SB VR input		
	A3	5	CRS	A/D channel 3, carr er sub VR input		
	A4	6	CRW	A/D channel 4, carrier w ndow VR nput		
	A5	7	–	Not used		
	A6	8	POD1	A/D channe 6, AT var able capacitor position VR1 nput	I	
	A7	9	POD2	A/D channe 7, AT variable capac.tor posit on VR2 nput	I	
Control	C0~C2	12~14	C0~C2	Channe se ect signal	I	
signal	CLK	16	CLK	A/D data select signa	I	
	CS	15	CS	Chip select	I	
	DO	17	DO	A/D data	O	
	Vref	19	Vref	A/D reference power supp y	O	5V
	RS	18	RS	Range select signal	I	Always 'H'
	S/D	11	S/D	Conversion mode signal		Always H'

CIRCUIT DESCRIPTION

6) SUB CPU : HD643180X0FS6 (Display unit IC1)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port	PA0	54	LFSK	FSK mode LED	O	"H" LED on
	PA1	55	LLSB	LSB mode LED	O	"H" LED on
	PA2	56	LUSB	USB mode LED	O	"H" LED on
	PA3	57	LFM	FM mode LED	O	"H" LED on
	RXS	58	EDT	Sub CPU serial data input	I	
	CKS	59	FCK	Sub CPU serial clock input	I	
	PA6	60	LAM	AM mode LED	O	"H" LED on
	PA7	61	LCW	CW mode LED	O	"H" LED on
E port	PE0	23				
	PE1	24				
	PE2	25	BSY	VS-2 busy input	I	"H" VS-2 busy
	PE3	28	TR	TX/RX input	I	"H" TX, "L" RX
Control port	PC0~PC7	6~14	A0~A7	CPU low-order address bus	O	
	PD0~PD7	15~22	A8~A15	CPU high-order address bus	O	
	PF0~PF7	30~37	D0~D7	CPU data bus	I/O	
	NM	1	NMI	Interrupt input for subtone synthesis		
	INT0~INT2	2~4	INT0~INT2	Not used	I	Fixed at "H" level
	RTS	45	TN2	1750 Hz tone control output	O	TONE ON, f=1750 Hz, TX "H"
	MP0,MP1	72,73	MP0,MP1	CPU mode setting input		MP0 "L", MP1 "H" fixed
	BUSRQ	79	BUSRQ	Not used	I	Fixed "H" level
	WAIT	77	WAIT	Not used	I	Fixed "H" level
	EXtal, Xtal	74,75	Extal,Xtal	Crystal connection pin		f=11.5 MHz

7) Gate array : MB622180PF (Display unit IC2)

	Port name	Pin No.	Name	Function	I/O	Remarks
P0 port	P00	34	Pa1	Fluorescent display tube segment a1 drive output	O	For TX VFO display
	P01	35	Pb1	Fluorescent display tube segment b1 drive output	O	7 segments (upper right)
	P02	36	Pc1	Fluorescent display tube segment c1 drive output	O	"H" Active
	P03	37	Pd1	Fluorescent display tube segment d1 drive output	O	
	P04	38	Pe1	Fluorescent display tube segment e1 drive output	O	
	P05	39	Pf1	Fluorescent display tube segment f1 drive output	O	
	P06	41	Pg1	Fluorescent display tube segment g1 drive output	O	
	P07	42	Ph1	Fluorescent display tube segment h1 drive output	O	
P1 port	P10	43	Pa2	Fluorescent display tube segment a2 drive output	O	For sub VFO display
	P11	44	Pb2	Fluorescent display tube segment b2 drive output	O	7 segments (yellow)
	P12	45	Pc2	Fluorescent display tube segment c2 drive output	O	"H" Active
	P13	46	Pd2	Fluorescent display tube segment d2 drive output	O	
	P14	47	Pe2	Fluorescent display tube segment e2 drive output	O	
	P15	48	Pf2	Fluorescent display tube segment f2 drive output	O	
	P16	49	Pg2	Fluorescent display tube segment g2 drive output	O	
	P17	50	Ph2	Fluorescent display tube segment h2 drive output	O	
P2 port	P20	55	Pa3	Fluorescent display tube segment a3 drive output	O	For main VFO display
	P21	56	Pb3	Fluorescent display tube segment b3 drive output	O	7 segments (Center)
	P22	57	Pc3	Fluorescent display tube segment c3 drive output	O	"H" Active
	P23	58	Pd3	Fluorescent display tube segment d3 drive output	O	
	P24	59	Pe3	Fluorescent display tube segment e3 drive output	O	
	P25	60	Pf3	Fluorescent display tube segment f3 drive output	O	
	P26	61	Pg3	Fluorescent display tube segment g3 drive output	O	
	P27	62	Ph3	Fluorescent display tube segment h3 drive output	O	

CIRCUIT DESCRIPTION

	Port name	Pin No.	Name	Function	I/O	Remarks
P3 port	P30	63	P1G	F uorescent·d splay tube grid 1G dr ve output	O	Gr d select signa
	P31	64	P2G	F uorescent d splay tube grid 2G dr ve output	O	The r ghtmost grid of the d sp ay
	P32	66	P3G	F uorescent d splay tube grid 3G dr ve output	O	tube is 1 (1G)
	P33	67	P4G	F uorescent d splay tube grid 4G dr ve output	O	'H' Active
	P34	68	P5G	F uorescent d splay tube grid 5G dr ve output	O	
	P35	69	P6G	Fluorescent display tube grid 6G drive output	O	
	P36	70	P7G	Fluorescent display tube grid 7G drive output	O	
	P37	71	P8G	Fluorescent display tube grid 8G drive output	O	
P4 port	P40	72	P9G	Fluorescent display tube grid 9G drive output	O	'H' . Act ve
	P41	73	P10G	Fluorescent display tube grid 10G drive output	O	
	P42	74	P11G	F uorescent display tube grid 11G drive output	O	
	P43	75	P12G	F uorescent display tube grid 12G drive output	O	
	P44	84	P13G	F uorescent display tube grid 13G drive output	O	
	P45	85	P14G	F uorescent display tube grid 14G drive output	O	
	P46	86	P15G	F uorescent display tube grid 15G drive output	O	
	P47	87	P16G	Fluorescent display tube grid 16G drive output	O	
P5 port	P50	88	P17G	Fluorescent disp ay tube grid 17G drive output	O	'H' . Active
	P51	89	P18G	Fluorescent disp ay tube grid 18G drive output	O	
	P52	91	P19G	Fluorescent disp ay tube grid 19G dr ve output	O	
	P53	92	P20G	Fluorescent disp ay tube grid 20G dr ve output	O	
	P54	93	P21G	Fluorescent display tube grid 21G drive output	O	
	P55	94	P22G	Fluorescent display tube grid 22G drive output	O	
	P56	95	P23G	Fluorescent display tube grid 23G drive output	O	
	P57	96	P24G	F uorescent d.splay tube grid 24G drive output	O	
P6 port	P60	97	PA1	F uorescent disp ay tube segment A1 dr ve output	O	'H' Active, analog scale
	P61	98	PA2	F uorescent disp ay tube segment A2 dr ve output	O	'H' Active, for red pointer disp ay
	P62	99	PB	Fluorescent disp ay tube segment B drive output	O	'H' Active
	P63	100	PC	Fluorescent disp ay tube segment C drive output	O	
	P64	1	PD	Fluorescent disp ay tube segment D dr ve output	O	
	P65	2	PE1	Fluorescent disp.ay tube segment E1 drive output	O	
	P66	5	PE2	Fluorescent display tube segment E2 drive output	O	
	P67	6	–	Not used		
P7 port	P70	7	PCC	Fluorescent display tube segment CC dr ve output	O	Meter scale select s gnal
	P71	8	PDD	Fluorescent display tube segment DD drive output	O	'H" Act.ve
	P72	9	PEE	Fluorescent disp ay tube segment EE dr ve output	O	
	P73	10	PFF	Fluorescent disp ay tube segment FF drive output	O	
	P74	11	P1	Fluorescent disp ay tube segment 1 drive output	O	Red etter disp ay segment
	P75	12	P3	F uorescent d.sp ay tube segment 3 drive output	O	'H" Act ve
	P76	13	P3	F uorescent d.sp ay tube segment ,3 drive output	O	For kHz display, 'H Active
	P77	14	PALL	Fluorescent disp ay tube segment ALL drive output	O	For analog scale display, "H' Active
Contro port	D0~D7	24~33	D0~D7	CPU data bus	I/O	
	A0~A2	21~23	A0~A2	CPU address bus		
	NRES	16	NRES	Reset input		'L' Reset
	NRD	17	NRD	RD strobe	I	'L Read
	NWR	18	NWR	WR strobe	I	'L Write
	NCS1	19	NCS1	Ch p select 1	I	'L Act.ve
	NCS0	20	NCS0	Chip select 0	I	'L' Act.ve
	EN0	51	EN0	Output control 0	I	'H" Active
	EN1	52	EN1	Output control 1	I	'H" . Act.ve
	CKI	81	CKI	Display control flip-flop clock	I	
	NCLI	82	NCLI	Display control flip-flop clear	I	
	DOUT	83	DOUT	Display control flip-flop output	O	
	DIR0	76	DIR0	Port I/O specification 0	I	Fixed 'L' level
	DIR1	77	DIR1	Port I/O specif cation 1	I	Fixed 'L' level

CIRCUIT DESCRIPTION

8) Gate array : MB622180PF (Display unit IC3)

	Port name	Pin No.	Name	Function	I/O	Remarks
P0 port	P00	34	PPWR	Fluorescent display tube segment PWR drive output	O	Meter selection segment
	P01	35	PS	Fluorescent display tube segment S drive output	O	"H" Active
	P02	36	PL30	Fluorescent display tube segment L30 drive output	O	Lower meter segment
	P03	37	PL29	Fluorescent display tube segment L29 drive output	O	"H" Active
	P04	38	PL28	Fluorescent display tube segment L28 drive output	O	
	P05	39	PL27	Fluorescent display tube segment L27 drive output	O	
	P06	41	PL26	Fluorescent display tube segment L26 drive output	O	
	P07	42	PL25	Fluorescent display tube segment L25 drive output	O	
P1 port	P10	43	PL24	Fluorescent display tube segment L24 drive output	O	Lower meter segment
	P11	44	PL23	Fluorescent display tube segment L23 drive output	O	"H" Active
	P12	45	PL22	Fluorescent display tube segment L22 drive output	O	
	P13	46	PL21	Fluorescent display tube segment L21 drive output	O	
	P14	47	PL20	Fluorescent display tube segment L20 drive output	O	
	P15	48	PL19	Fluorescent display tube segment L19 drive output	O	
	P16	49	PL18	Fluorescent display tube segment L18 drive output	O	
	P17	50	PL17	Fluorescent display tube segment L17 drive output	O	
P2 port	P20	55	PL16	Fluorescent display tube segment L16 drive output	O	Lower meter segment
	P21	56	PL15	Fluorescent display tube segment L15 drive output	O	"H" Active
	P22	57	PL14	Fluorescent display tube segment L14 drive output	O	
	P23	58	PL13	Fluorescent display tube segment L13 drive output	O	
	P24	59	PL12	Fluorescent display tube segment L12 drive output	O	
	P25	60	PL11	Fluorescent display tube segment L11 drive output	O	
	P26	61	PL10	Fluorescent display tube segment L10 drive output	O	
	P27	62	PL9	Fluorescent display tube segment L9 drive output	O	
P3 port	P30	63	PL8	Fluorescent display tube segment L8 drive output	O	Lower meter segment
	P31	64	PL7	Fluorescent display tube segment L7 drive output	O	"H" Active
	P32	66	PL6	Fluorescent display tube segment L6 drive output	O	
	P33	67	PL5	Fluorescent display tube segment L5 drive output	O	
	P34	68	PL4	Fluorescent display tube segment L4 drive output	O	
	P35	69	PL3	Fluorescent display tube segment L3 drive output	O	
	P36	70	PL2	Fluorescent display tube segment L2 drive output	O	
	P37	71	PL1	Fluorescent display tube segment L1 drive output	O	
P4 port	P40	72	PBB	Fluorescent display tube segment BB drive output	O	Meter scale selection
	P41	73	PAA	Fluorescent display tube segment AA drive output	O	"H" Active
	P42	74	PU30	Fluorescent display tube segment U30 drive output	O	Upper meter segment
	P43	75	PU29	Fluorescent display tube segment U29 drive output	O	"H" Active
	P44	84	PU28	Fluorescent display tube segment U28 drive output	O	
	P45	85	PU27	Fluorescent display tube segment U27 drive output	O	
	P46	86	PU26	Fluorescent display tube segment U26 drive output	O	
	P47	87	PU25	Fluorescent display tube segment U25 drive output	O	
P5 port	P50	88	PU24	Fluorescent display tube segment U24 drive output	O	Upper meter segment
	P51	89	PU23	Fluorescent display tube segment U23 drive output	O	"H" Active
	P52	91	PU22	Fluorescent display tube segment U22 drive output	O	
	P53	92	PU21	Fluorescent display tube segment U21 drive output	O	
	P54	93	PU20	Fluorescent display tube segment U20 drive output	O	
	P55	94	PU19	Fluorescent display tube segment U19 drive output	O	
	P56	95	PU18	Fluorescent display tube segment U18 drive output	O	
	P57	96	PU17	Fluorescent display tube segment U17 drive output	O	

CIRCUIT DESCRIPTION

	Port name	Pin No.	Name	Function	I/O	Remarks
P6 port	P60	97	PU16	Fluorescent display tube segment U16 drive output	O	Upper meter segment
	P61	98	PU15	Fluorescent display tube segment U15 drive output	O	'H' Active
	P62	99	PU14	Fluorescent display tube segment U14 drive output	O	
	P63	100	PU13	Fluorescent display tube segment U13 drive output	O	
	P64	1	PU12	Fluorescent display tube segment U12 drive output	O	
	P65	2	PU11	Fluorescent display tube segment U11 drive output	O	
	P66	5	PU10	Fluorescent display tube segment U10 drive output	O	
	P67	6	PU9	Fluorescent display tube segment U9 drive output	O	
P7 port	P70	7	PU8	Fluorescent display tube segment U8 drive output	O	Upper meter segment
	P71	8	PU7	Fluorescent display tube segment U7 drive output	O	'H' Active
	P72	9	PU6	Fluorescent display tube segment U6 drive output	O	
	P73	10	PU5	Fluorescent display tube segment U5 drive output	O	
	P74	11	PU4	Fluorescent display tube segment U4 drive output	O	
	P75	12	PU3	Fluorescent display tube segment U3 drive output	O	
	P76	13	PU2	Fluorescent display tube segment U2 drive output	O	
	P77	14	PU1	Fluorescent display tube segment U1 drive output	O	
Contro port	D0~D7	24~33	D0~D7	CPU data bus	I/O	
	A0~A2	21~23	A0~A2	CPU address bus	I	
	NRES	16	NRES	Reset input	I	'L' Reset
	NRD	17	NRD	RD strobe	I	'L' Read
	NWR	18	NWR	WR strobe	I	'L' Write
	NCS1	19	NCS1	Chip select 1	I	'L' Active
	NCS0	20	NCS0	Chip select 0	I	'L' Active
	EN0	51	EN0	Output control 0	I	'H' Active
	EN1	52	EN1	Output control 1	I	'H' Active
	CKI	81	CKI	Main CPU busy control flip-flop clock	I	
	NCL	82	NCLI	Main CPU busy control flip-flop clear	I	
	DOUT	83	DOUT	Main CPU busy control flip-flop output	O	
	D R0	76	D R0	Port I/O specification 0		Fixed 'L' level
	D R1	77	D R1	Port I/O specification 1		Fixed 'L' level

9) Latch : TC74HC574AF (Display unit IC5)

	Port name	Pin No.	Name	Function	I/O	Remarks
Q port	Q0	19	-	Not used	O	
	Q1	18	LTM	TX-M LED output	O	'H' LED on
	Q2	17	LTA	TX-A LED output	O	'H' LED on
	Q3	16	LTB	TX-B LED output	O	'H' LED on
	Q4	15	LK1	Numeric keys 0 to 9 LED output	O	'H' LED on
	Q5	14	LRM	RX-M LED output	O	'H' LED on
	Q6	13	LRA	RX-A LED output	O	'H' LED on
	Q7	12	LRB	RX-B LED output	O	'H' LED on

CIRCUIT DESCRIPTION

AVR Unit

The power supply unit produces +15 V through the use of a discrete IC, +5 V and –12 V via 3-pin regulator IC's, and –40 V through the use of a zener diode and transistor.

The +15V circuit is very similar to the +28V circuit of the TS-940. When the power is switched on, Q2 is turned on via start resistors R3 and R24 and current flows. A voltage is generated at R8 and R9. Error amplifier transistor Q4 is turned on while Q1 is turned on.

The circuit operates as a constant-voltage circuit with a reference voltage of 7.5 V which is produced by zener diode. Diode D2 (negative temperature coefficient) is used to compensate for the temperature (positive temperature coefficient) of this zener diode. A current of up to 5.5 A flows through Q2, resulting in a collector loss of approximately 35 W. R4 is a resistor that is used for stabilization, and has a current flow of approximately 100 mA to stabilize operation even if there is no load.

If the +15 V line is shorted, F1 (7.5 A quick-blow fuse) blows to protect the circuit.

The +5 V is generated from the +15 V line by a 3-pin regulator IC.

–40 V is produced by two –20V zener diodes, and boosted by Q5. R13 is a protection resistor, and R14 and R23 are resistors for discharging C30 and C34.

When the temperature of the power supply radiator reaches 50°C, thermal switch S2 is turned on, and a fan start voltage of approximately 7 V is generated by D4. The fan begins running at a low speed. When the temperature of the transformer rises to 80°C, S1 turns off, and Q3 turns on. The fan voltage then becomes approximately 12 V, and the fan rotates at high speed while a powerdown signal (approximately 5 V) is output (CN5-1 TPT).

Digital Modulation Function

This transceiver is capable of providing the SSB, CW, AM and FSK modulation generating or FM carrier, and providing the AF slope tune during the SSB receive by using the input signals from the microphone and a 16-bit A/D, D/A converter for CW and FSK keying and DSP (Digital Signal Processor).

- **Features of each mode**

1) SSB mode

Modulated waves of higher-quality than those in the SSB mode are obtained through modulation by the 10th phase shift network that digitally theats signals.

2) CW mode

Excellent characteristics are obtained through digital form-restoration of the wave shape.

3) AM mode

Low-distortion modulated waves with excellent amplitude and group delay characteristics are obtained through digital modulation and by using the 84th FIR filter.

4) FM mode

Provides the high-quality 455 kHz carrier. DSP-10 does not provide modulation.

TS-950S/SD

CIRCUIT DESCRIPTION

5) FSK mode

Excellent, low-distortion modulated waves are obtained through FSK modulation with continuous phasing after the digital form restoration of the rising form and characteristic of the waveform.

6) SSB mode (received)

AF slope tuning is provided by the digital filter, to suit the slope of this transceiver.

DSP Unit

- **Outline and configuration**

The DSP-10 is provided to digitally process transmitter signals in the SSB, CW, AM, and FSK modes, and it is also used to provide AF-slope tuning in the SSB receive mode.

Figure 38 is a block diagram of the DSP-10. The DSP-10 consists of a digital unit, which performs digital signal processing, an analog unit, which processes analog signals and sends them to the digital unit, and converts the input from the digital unit back to analog signals, and a PLL unit, which generates clock pulses for managing the frequencies in the main unit and performing digital signal processing with an accurate sampling frequency.

1) Modulation

The MIC audio signal is applied to an input buffer where the low frequency components are eliminated by a high-pass filter, composed of C1 and C2 (MC74HC4052F), which is used to limit the bandwidth of the signal. The output of the high pass filter is routed through limiting amplifier IC6 (NJM4560M) and IC7/1 (NJM4558M) to limit the input amplitude before the signal is applied to the A/D converter. Components of the signal outside the Nyquist band are eliminated by a low-pass filter consisting of IC7/2, IC8, and IC9 (NJM4558M). The resulting signal is converted into a Pulse Coded Modulated (PCM) waveform by the sample and hold amplifier circuit consisting of IC10, C11 (NJM0728M), and Q1 (2SK508), and is then applied to the A/D converter IC12 (PCB78AP). The signal is then converted into a digital signal with a sampling frequency of 49.189 kHz by IC12 (PCM78AP). In the SSB and AM modes, the resulting digital signal is used as the modulating signal.

The leading and trailing edges of the shift data from CW keying and RTTY are checked by the DSP. When the edge of the waveform is detected, data regarding the square/cosine characteristics is read sequentially from the ROM. This data is used to either modulate the amplitude or frequency.

Note : 49.189 means 49 189189189... (recurring decimal).

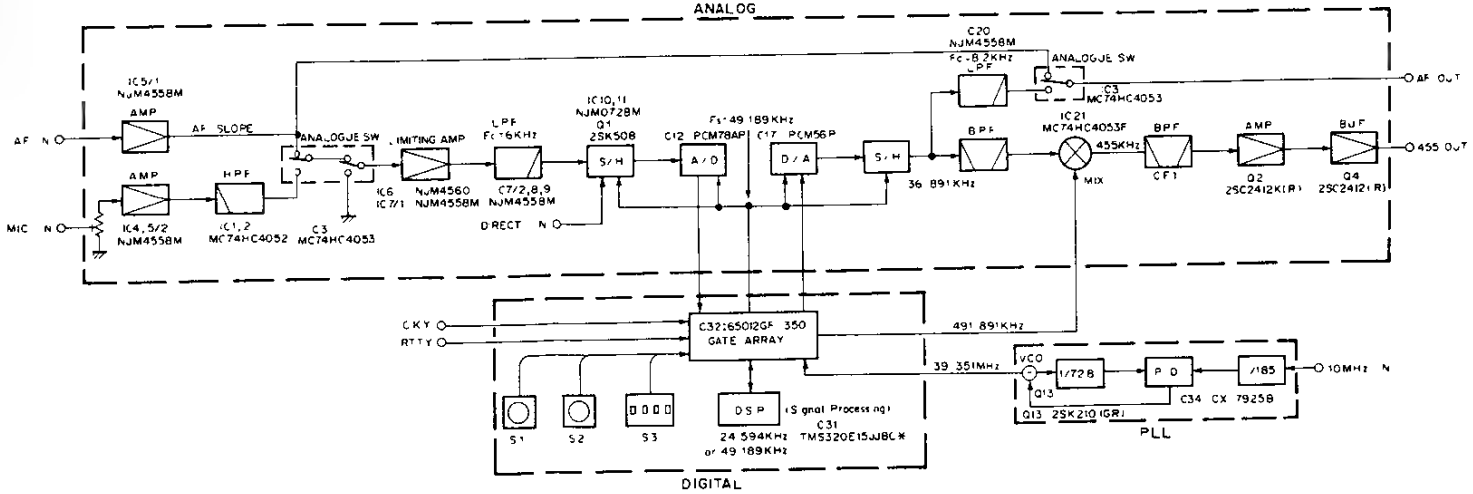


Fig. 38 DSP unit block diagram

The modulated waveform that has been digitally processed and supplied by the D/A converter IC17 (PCM56P) has a modulation spectrum rich in odd order harmonics that are 1/4 the sampling frequency (1/4, 3/4, 5/4, etc). A frequency of 36.891 kHz, which is 3/4 the sampling frequency, is taken by the bandpass filter and is mixed with a frequency of 491.891 kHz by IC21 (MC74HC4053F) in order to generate a signal of 455 kHz. The unwanted adjacent components of this signal are eliminated by ceramic filter CF1, amplified by Q2 (2SC2412K), and output from buffer amplifier Q4 (2SC2412K). In the CW and AM modes, the output level is reduced in order to match the level of the main unit.

Figure 39 shows the frequency spectrum of the MIC input, A/D input, D/A output, 36.891-kHz bandpass filter output, and 455-kHz output.

Item	Rating
Nominal center frequency (fo)	455kHz
3dB bandwidth	±5.0kHz or more (from 455kHz)
6dB bandwidth	±7.5kHz or more (from 455kHz)
70dB bandwidth	±12.5kHz or less (from 455kHz)
Guaranteed attenuation	80dB or more at 455±100kHz 50dB or more at 0.1 to 1MHz
Ripple	3dB or less at 455±5.0kHz 6dB or less at 455±7.5kHz
Insertion loss	6dB or less
Voltage capacity (between pins)	50V DC (1 minute)
Input and output impedance	1.5kΩ

Table 11 Ceramic filter (L72-0375-05) (DSP unit CF1)

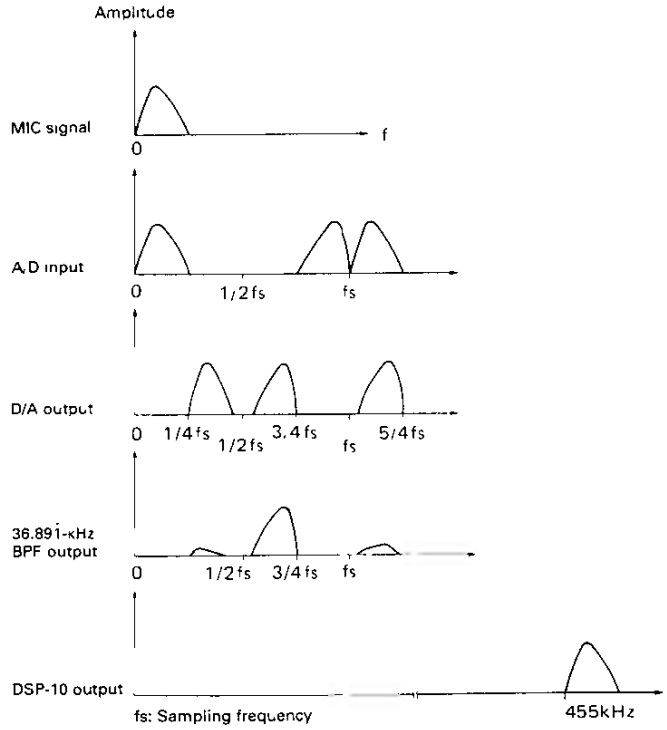


Fig. 39 Frequency spectrum in SSB mode

2) AF-SLOPE TUNE

The audio signal supplied from the input buffer amplifier IC5/1 (NJM4558M), like the MIC signal, is passed through the limiting amplifier in order to limit the level of the signal applied to the A/D converter. The signal then passes through the low-pass filter. This signal is then converted into a Pulse Code Modulated waveform by the sample and hold amplifier circuit before it is applied to the A/D converter. The signal is converted to a digital signal with a sampling frequency of 49.189 kHz by the A/D converter. Further processing of the signal is accomplished in the Digital unit. This signal is then applied to the D/A Converter IC17 where the now processed audio is obtained.

The PCM signal from the D/A converter is passed through low-pass filter IC20 (NJM4558M) to eliminate undesirable harmonics and smooth the signal. Its level is equalized with the input level, switched by analog switch IC3 (MC74HC4053F), and applied to the AF OUT terminal.

Figure 40 shows the frequency characteristics of the audio input, low-pass filter output, A/D input, D/A output, and resulting audio output.

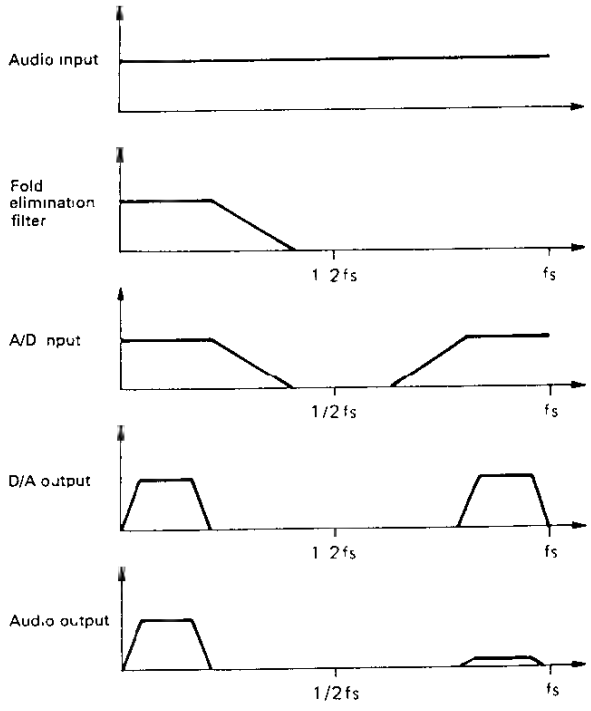


Fig. 40 Frequency characteristics of AF SLOPE TUNE

3) Frequencies

The DSP-10 reference signal of 10 MHz (1/2 the reference oscillator signal of 20 MHz) is multiplied by 728/185 in the DSP PLL unit. This signal is applied to gate array IC32 (μPD65012GF-350) of the digital unit as the 39.351-MHz internal reference signal.

The gate array divides the signal by 1/800 to generate a sampling clock of 49.189 kHz, and again divides the signal by 1/80 to generate a 491.891-kHz clock signal that is used for mixing.

The frequency of the harmonic free signal supplied by the D/A converter is 36.891 kHz, which is 3/4 the sampling frequency. The 455-kHz IF output is produced by taking the difference between this frequency and the 491.891 kHz mixing frequency.

- **PLL unit**

The PLL circuit is a relatively conventional PLL circuit that is used to obtain a fixed reference frequency that is used for each clock circuit used in the DSP unit.

The Phase Detector of the PLL circuit is IC34 (CX-7925B). The incoming reference frequency of 10 MHz is amplified by amplifier Q12 and applied to pin 5 of IC34. Here the signal is divided by 1/185 in order to generate a comparison frequency of 54.054 kHz. The output from the VCO passes through buffer amplifier Q14, and is applied to pin 11 of IC34. Here it is divided by 1/728, and compared with the 54.054 kHz reference signal in order to lock the VCO.

Division ratio data is sent from the main unit via the digital unit on the DMA2, DCK2, and DLE2 lines. The PLL output is supplied to the digital unit via buffer amplifier Q15 where it is used as an internal reference.

$f_{DSPSTD} = 728/185 \times 1/2\ f_{STD} = 728/185 \times 10 \times 10^6$

$f_{MIX} = f_{DSPSTD}/80 \qquad f_S = f_{DSPSTD}/800$

$f_{455} = f_{MIX} - 3/4\ f_S$

$= 37/3200\ f_{DSPSTD} - 37/3200 \times 1456/37 \times 10^6$

- **Digital unit**

The digital unit consists of DSP IC31 (TMS320E15), gate array IC32 (μPD65012GF-350), write signal control IC36 (MM74HCT00M), reset IC33 (S-8054ALR-LN), and amplifier Q16 (2SC2714), which amplifies the internal reference to the necessary level before it is applied to the gate array.

1) DSP

A 25-MHz crystal oscillator signal is used for the DSP internal clock circuits. The DSP operates on an clock signal of 6.25-MHz (160 ns) which is 1/4 the crystal oscillator frequency.

Data is transferred between the A/D and D/A converters and signals are received from the main unit via the gate array.

2) Write signal control

Since it is possible that the DSP address data may become invalidated before the falling of control signals WE, MEN, and DEN, the WE control signal is gated by the DCLK line to prevent malfunctions of the gate array.

3) Internal reference signal amplifier

The internal reference signal from the PLL is amplified to approximately 3.6 Vp-p, raised to the appropriate DC bias level, and applied to the CLK line of the gate array.

4) Switches

S1, S2, and S3 are recognized by the DSP only when the mode is changed normally (i.e. when commands are received from the main unit). They are recognized only when the system is reset in the test mode. Therefore, changes in the settings of these switches do not become valid by just changing the switch settings. The only exception is the high-pass filter in the analog unit, it is controlled directly by S1.

5) Gate array

The gate array generates internal/external clocks signals from the internal reference provided by the PLL; interfaces with the analog unit; generates the DSP reset signal; receives commands from the main unit to the DSP and input switches S1, S2, and S3.

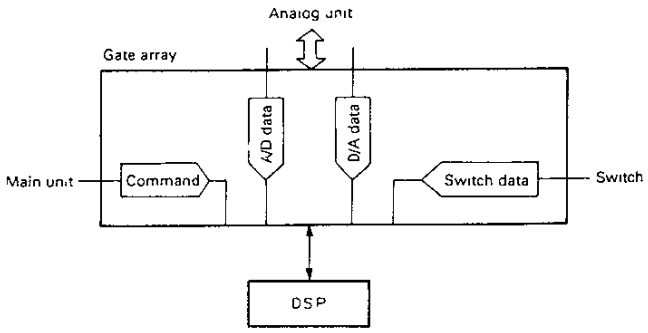


Fig. 41 Data flow in the digital unit

Reception of commands from the main unit

When MEN (MLE) is low, the MDA (ISD) data is read into the internal shift register synchronized with the leading edge of the MCK (ISC) signal. Data is latched in the internal buffer register by reading the 16-bit data and making MEN (MLE) high which generates an interrupt (NINT) to the DSP. The output from NINT is synchronized with the leading edge of the DCLK signal from the DSP.

CIRCUIT DESCRIPTION

· **Reset**

The leading edge of the reset signal applied to the NRS line from IC33 is delayed by the signal that is obtained by dividing the internal reference signal and is then applied to the NRES line.

The negative pulse to the NMR line is also delayed by the signal that is obtained by dividing the internal reference signal and is then applied to the NRES line.

The delay time in both cases is approximately 1.3 msec.

· **BIO signal**

The pulse that is synchronized with the sampling frequency, fs, is output to the BIO so that it is synchronized with the leading edge of the DCLK signal from the DSP.

The BIO signal output from the gate array is applied to the BIO line of the DSP. The DSP performs processing for each sample in synchronization with the BIO line

· **Analog data and interface**

16-bit serial data read from the A/D converter: ADDT, CK17, CC

16-bit serial data written to the D/A converter. DADT, CK17, LEC

Data sample timing for sample hold amplifier SH

Timing for output duty variable circuit. ANSW.

For ADDT, CK17, CC, DADT, CK17, LEC, SH, and ANSW, the timing is synchronized with the sampling period and is generated by the gate array.

The mixing clock (MIX) is turned off during AF-SLOPE operations

MODE	MDO0	MDO1	MDO2
SSB	0	1	0
CW	1	1	0
AM	1	1	0
FM	0	1	0
FSK	0	1	0
AF SLOPE	0	0	0
RX other than SSB	0	1	0

Table 12 IC3, Q3 control (MDO0 to MDO2)

Cut-off	HPF1	HPF2
110	1	1
200	1	0
300	0	1
400	0	0

Table 13 HPF cut-off change (HPF1, 2)

Terminal Name	I/O	Function	Terminal Name	I/O	Function
DBA~DBF	I/O	Data bus	MDO2	O	Low pass filter input muting
A0~A2,A11	I	Address bus	SDT0		High-pass filter setting 1SB
NWE	I	Write signal	SDT1	I	High-pass filter setting 2SB
NDEN	I	Read signal	SDT2	I	Low-pass filter setting 1SB
NMEN		Memory recall	SDT3	I	Low pass filter setting 2SB
BIO	O	Sampling timing	SDT4		CW leading edge characteristics
DCLK	I	DSP timing clock	SDT5		SSB ripple characteristics
NINT	O	DSP interrupt	SDT6		AF slope wide/narrow
NRES	O	DSP reset	SDT7		S3 extension
NRS	I	Gate array reset	SDT8		Test (TP5)
MIX	O	Clock for converting the D/A output to 455 kHz	SDT9	I	TXB
SH	O	Sample and hold amplifier sampling timing	KEY	I	CKY
LEC	O	D/A converter command	SFT	I	RTTY
ADDT	O	Data from A/D converter	ISD	I	Serial data for commands
CK17	O	Serial transmission clock	ISC		Serial clock for commands
CC	O	A/D converter command	EN	I	Command data enable
DADT	O	Data to D/A converter	NMR	I	Manual reset input
ANSW	O	D/A output duty variable	CLK	I	Reference clock input
MDO0	O	DM.C-DAF1 change, DAF1-DAF2 through	NTST	I	For test
MDO1	O	ATT control	NTS2		

Table 14 Functions of gate array terminals

CIRCUIT DESCRIPTION

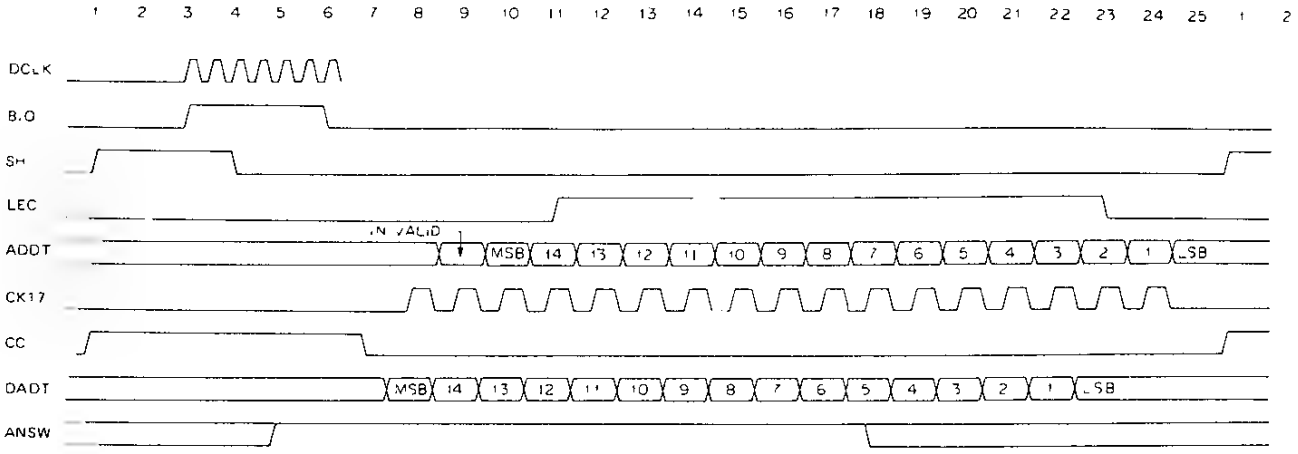


Fig. 42 Timing chart for gate array

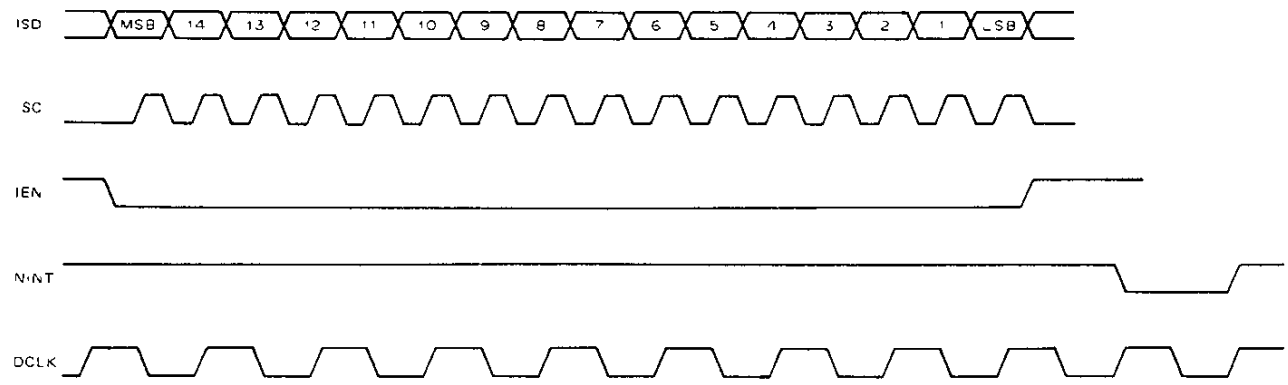


Fig. 43 Serial data entry and interrupt generation

CIRCUIT DESCRIPTION

- **Analog unit**

1) High-pass filter IC1, IC2 (MC74HC4052F)

The high-pass filter used for modulation processing is not a digital filter, but an analog filter because of the processing ability of the DSP. This high-pass filter allows to operator to program up to 4 different cut-off frequencies in order to select the desired tone.

S1	HPF1	HPF2	Y	X	Cut-off frequency (–3dB)
0, 4, 8	1	1	Y3	X3	75Hz
1, 5, 9	1	0	Y2	X2	185Hz
2, 6	0	1	Y1	X1	300Hz
3, 7	0	0	Y0	X0	400Hz

- **MIC input high-pass filter**

This active high-pass filter is configured as a fourth degree Butterworth filter and is controlled in four steps by IC1 and IC2.

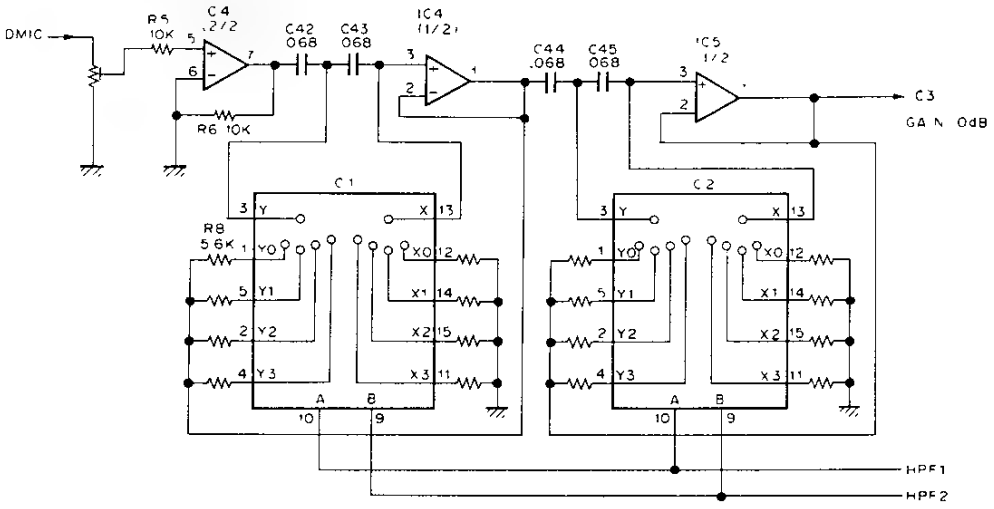


Fig. 44 MIC input high-pass filter

2) Limiting amplifier
IC6 (NJM4560M), IC7/1 (NJM4558M)

When a signal with too much amplitude is applied to the A/D converter it is possible to experience large levels of distortion. To prevent this, the amplitude of the incoming signal is clipped by up to 3.2 Vp-p by a limiting amplifier to ensure that the level applied to the A/D converter (IC12 pin 1) does not exceed 6 Vp-p full scale.

When the output amplitude is between the specified limits (as illustrated in the accompanying diagram) the limiting amplifier operates as a 20-dB amplifier.

When the amplitude exceeds these limits, D2/1 turns on. When the amplitude exceeds Vc–, D2/2 turns on to clip the amplitude so that the output amplitude is between Vc+ and Vc–.

The shapes of the signal peaks become irregular because of the delay of the operational amplifier (IC6) and diode (D2), but this poses no problem.

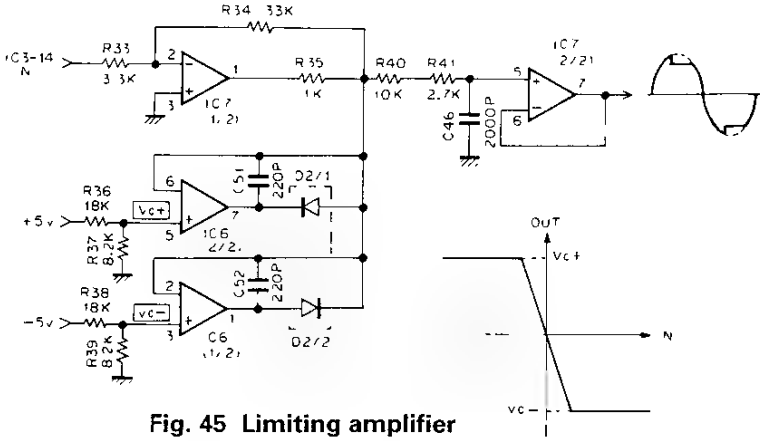


Fig. 45 Limiting amplifier

3) Sample and Hold

This is an integration type A/D converter that samples analog signals and keeps the input level of the A/D converter constant during the conversion process.

When 0 V is applied to the gate of Q1, Q1 turns on charging C53. When a negative voltage is applied to the gate of Q1, Q1 turns off the voltage during sampling is maintained at a constant level.

If Q1 is always on, the amplifier operates as an inversion amplifier whose gain is determined by R59 and R58. The gain is 0 dB.

R69 and R70 are protection resistors for IC10/1 and IC11/1.

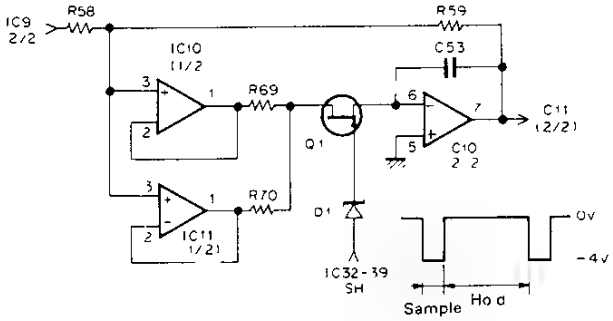


Fig. 46 Sample and hold circuit

4) LPF

This LPF is an sixth degree active Butterworth filter. This filter eliminates folded distortion and prevents signal-to-noise ratio reduction and distortion caused by the entry of unwanted signal components into the A/D converter.

5) D/A converter circuit

The D/A converter output is converted to the wedge type with a 50% duty during processing. The D/A converter output is distributed directly during AF-SLOPE operations. The frequency characteristics (aperture effect or early roll-off) of the D/A converter output are improved by taking the output with a 50% duty during processing.

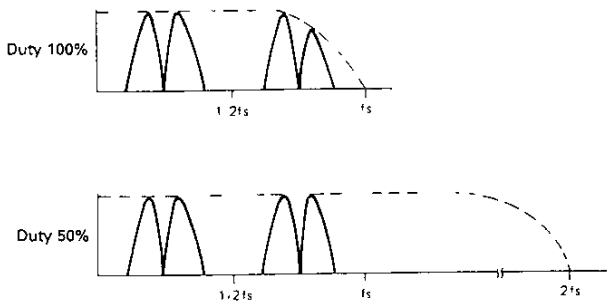


Fig. 47 Aperture effect

6) D/A output sampling circuit

Turns the D/A output on and off with the analog switch.

Turns the output on and off with a 50% duty during transmission in the SSB, CW, AM, and FM modes. Always on during AF-SLOPE TUNE. IC19 eliminates the analog switch output, and operates as a buffer amplifier.

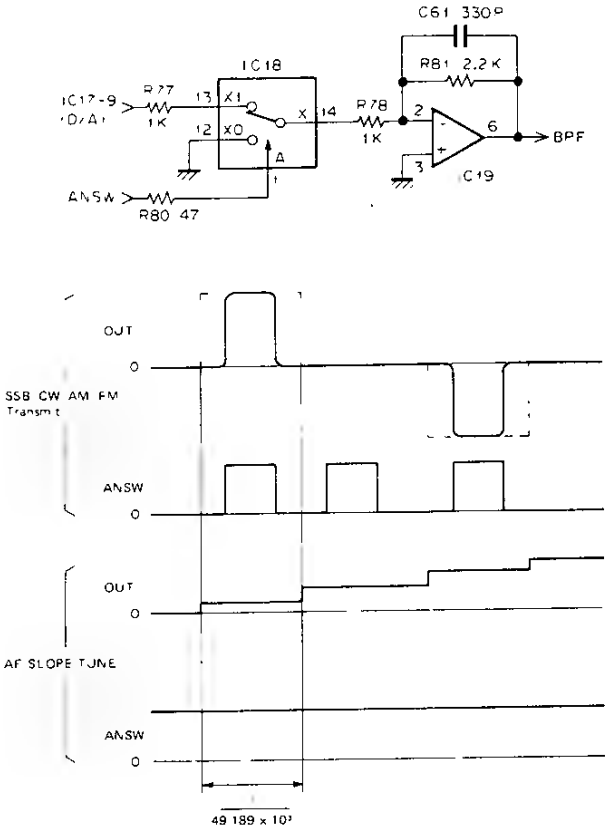


Fig. 48 D/A output sampling circuit

7) ATT

Turns on Q3 in the CW and AM modes, forming a voltage divider circuit on the output of Q2 that is composed of R96 and R97 to reduce the signal level applied to Q4.

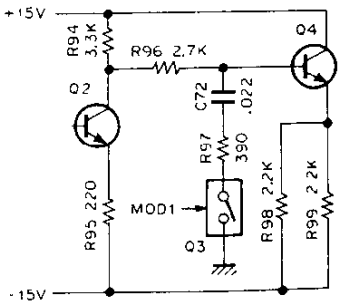


Fig. 49 ATT

CIRCUIT DESCRIPTION

8) Mixer

Combines the 36.891 kHz signal with the 491.891 kHz signal to produce the 455 kHz output. Q5 is an input buffer; Q6, an output buffer.

Since this mixer is used to combine square waves, it generates many harmonics of 491.891 kHz, but it does have the desirable characteristic of producing less distortion and noise than IC type mixers.

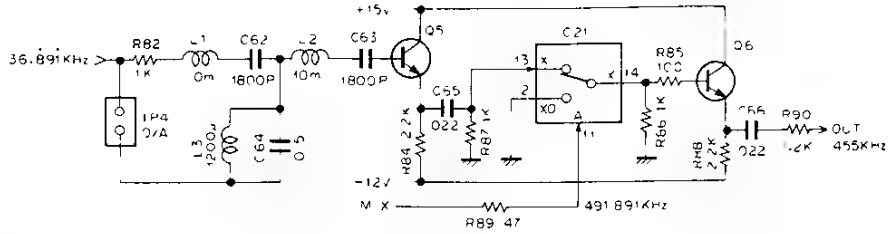


Fig. 50 Mixer

- **Description of digital signal processing**

The DSP-10 converts the analog signal to a digital signal to implement modulation and filtering by numeric means rather than using conventional RC circuits and analog ICs.

Since the modulation and filtering performed by the DSP-10 do not suffer from the inaccuracies of conventional analog processing methods is possible to provide ideal properties.

The DSP-10 uses a sampling frequency of 49.189 kHz for the A/D and D/A converters. When it is preferable to use a lower sampling frequency to reduce the processing time and improve performance, the sampling frequency is reduced by 1/2 or 1/4.

1) SSB modulation

- **Overview of processing**

Several different methods are available for digitally processing an SSB signal, they include the direct modulation method, the Weaver method, and the Hartley method. The DSP-10 uses the direct modulation method.

There are two generally accepted direct modulation methods. the filter method which removes the unnecessary sideband thru the use of an analog filter, or the method that suppresses the unnecessary sideband by generating a copy of the incoming audio signal that has had its phase shifted by 90 degrees thru the use of a phase shift network (PSN) and adding it with the original signal and carrier. Since the second method results in an SSB signal that has been obtained thru the use of phase shifts the use of a filter with steep cutoff characteristics, such as the ones used in the filter method, is not required. Therefore a higher sideband suppression ratio can be obtained from the low-frequency range using this broadband phase shifter. This method is far superior to the filter method in obtaining a wide frequency response. In the past this method has not been used much because it has been difficult to obtain a PSN (Phase Shift Network) with good characteristics due to variations in parts tolerances, circuit stability, and errors in circuit adjustment.

The DSP-10 uses the PSN method to generate SSB with good characteristics thru the use of an accurate, stable phase shifter obtained by digital signal processing.

The modulated signal from the A/D converter is applied to a LPF to limit the bandwidth. The signal is then split applied to the Phase shift network where the phase of the two signals is shifted by 90 degrees. The resulting signals, with a phase difference of 90 degrees, are mixed with carrier signals that are also 90 degrees out of phase with each other. The two resulting signals are then subtractively mixed to produce the SSB signal. The carrier of the SSB modulated wave is suppressed thru the use of a digitally controlled comb type filter and then exits the D/A converter.

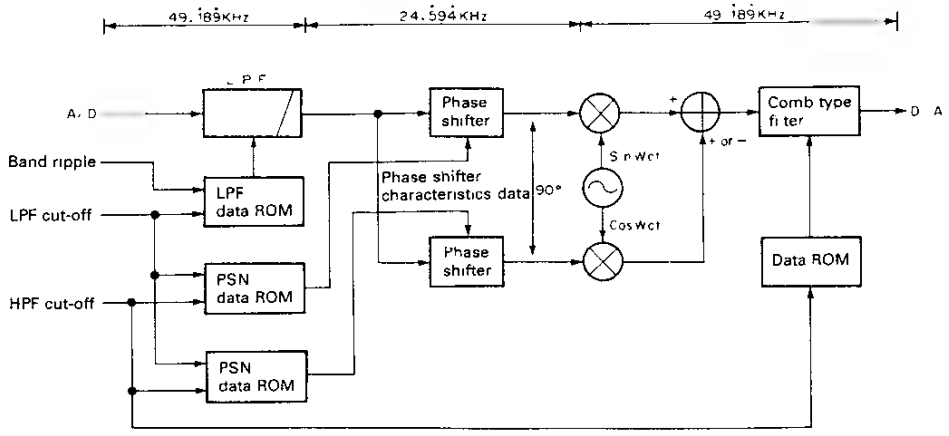


Fig. 51 SSB modulation block diagram

CIRCUIT DESCRIPTION

Functions

The LPF is a 5th order programmable Chebshev design. It allows the cut-off frequencies to be changed in four steps and the ripple in the band to be selected between 0.01 dB and 1.6 dB. When the ripple is set for 0.01 dB, the group delay characteristics are primary, i.e., the sound quality is considered to be the most important. When the ripple is set for 1.6 dB, the transition band characteristics are primary, i.e., the band width is considered to be the most important.

The DSP-10 uses two 5th order phase shifters, each consisting of five all-range passing-type phase shifters connected vertically to obtain sideband suppression characteristics of 70 dB or more. To further improve the sideband suppression characteristics, the degree of phase shift is increased or the 90-degree bandwidth of the phase shifter is narrowed.

Increasing the degree of the phase shifter is not desirable because the group delay characteristics deteriorate and faster processing is required. The DSP-10 implements the optimum characteristics for each transmit band by changing the design band ratio and frequency of the phase shifter by a combination of a high-pass filter and a low-pass filter.

Table 15 lists the various of high-pass filters and low-pass filters combinations which are selected to improve the sideband suppression ratio when the bandwidth is narrow.

Theoretically, there is no carrier leakage by the digital multiplier. However, it does occurs due to the offset voltage that is generated by the noise produced in the processing of the phase shifter. To prevent this, the DSP-10 uses a digital comb-type filter to suppress carriers. Whenever MIC input is present, this filter makes the carrier leakage below measurable levels.

The cut-off of the high-pass filter for suppressing the leakage on the opposite sideband of the phase shifter is the overall cut-off of the analog high-pass filter and comb-type filter.

HPF	LPF	Phase shifter band
110	2600, 2750	60~3435Hz/70dB
	2900, 3100	75~4296Hz/70dB
200	2600, 2750	129~3696Hz/74dB
	2900, 3100	75~4296Hz/70dB
300	2600, 2750 2900, 3100	190~5423Hz/74dB
400	2600, 2750 2900, 3100	220~6303Hz/74dB

Note
The bandwidth of the phase shifter are those before quantization, and therefore do not exactly match the actual bandwidths.

Table 15

2) CW

The 455-kHz carrier is generated or stopped according to the data supplied by the keying device. The DSP detects the leading edge (KEY down) and trailing edge (KEY up) of the keying signal, reads data from the internal square cosine characteristics ROM, modulates the amplitude according to the data, and obtains the shaped CW output.

A filter with square/cosine characteristics is used to shape the waveform for data communication. The filter has the advantage that it reduces the questionable status (0 or 1) at the data change point caused by overshooting of waveforms, and decreases the bandwidth caused by data change.

It is difficult for an analog filter with these characteristics to name equivalent amplitude characteristics, and it must have near phase. Therefore, it can have only approximate characteristics. In addition, this filter is very complicated. The DSP-10 provides good transmit waveforms, in which even steep CW waveforms have no KEY clicks, without having to resort to the use of analog filters.

When the CW spectrum of the DSP-10 is viewed with a spectrum analyzer, the spectrum is concentrated at the carrier. Since the transmission bandwidth is narrow, there is less influence even when the receiver passes signals through a narrow-band filter than before.

The CW leading edge characteristic is normally 2 msec. The operator can select from several values between 2 msec and 4 msec.

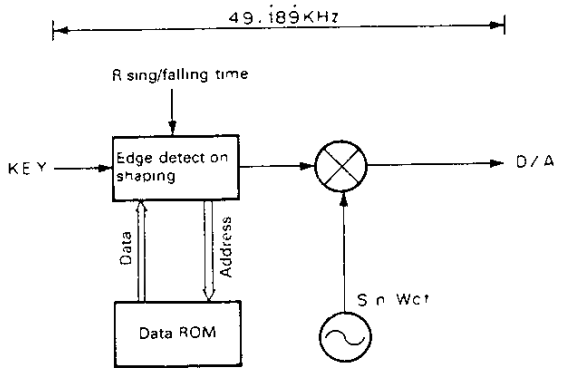


Fig. 52 CW block diagram

CIRCUIT DESCRIPTION

3) AM

The bandwidth of the modulating signal from the A/D converter is limited by the low-pass filter, given a specific offset, and is multiplied by the carrier to produce the modulated AM signal.

The low-pass filter is an Finite Impulse Response (FIR) digital filter of the 84th degree, which provides good frequency characteristics and flat group delay characteristics. Additionally, since linear modulation processing is performed with a digital multiplier, modulated waves with little distortion are obtained up to levels of 100% modulation.

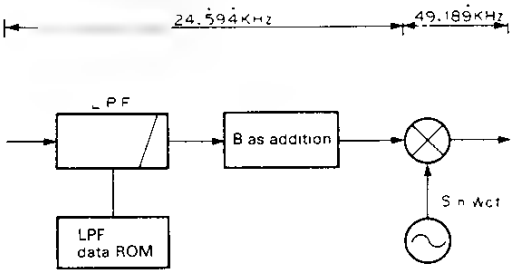


Fig. 53 AM modulation block diagram

4) FSK

The mark and space frequencies are generated directly by digital signal processing according to the frequency shift data from the RTTY line (DDS).

The DSP detects the leading and trailing edges of the shift signal. The DSP reads the data from the internal square cosine characteristics ROM and obtains the shaped FSK as the DDS frequency data. The mark frequency does not greatly interfere with the space frequency because of the square cosine waveform shaping characteristics, as in the CW mode, and because FSK modulation is performed with continuous phases. There is, therefore, less character change or bit errors when demodulating the signal.

Strictly speaking, the actual shift width is not 170,200, 425, and 850, but 171.129, 201.152, 426.322, and 849.642 due to the frequency steps that can be generated by the DSP. This should not prove to be of any practical concern.

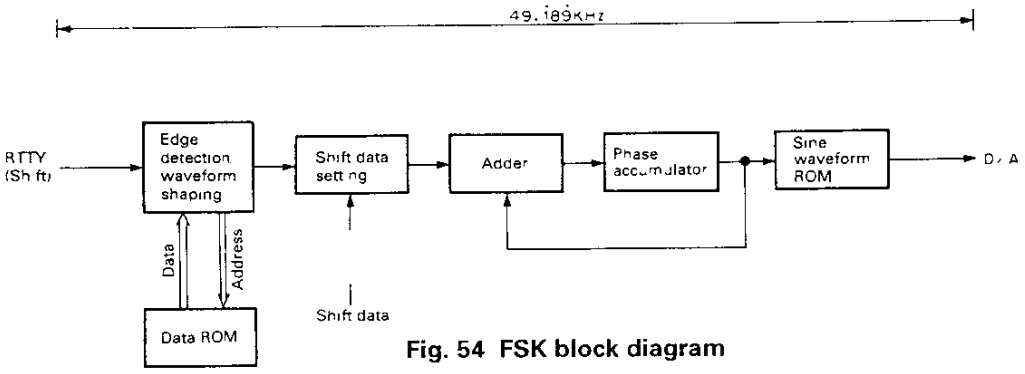


Fig. 54 FSK block diagram

5) AF-SLOPE TUNE

Interlocked with the SSB-SLOPE TUNE control of the main unit, this functions as the AF-SLOPE TUNE for the audio band.

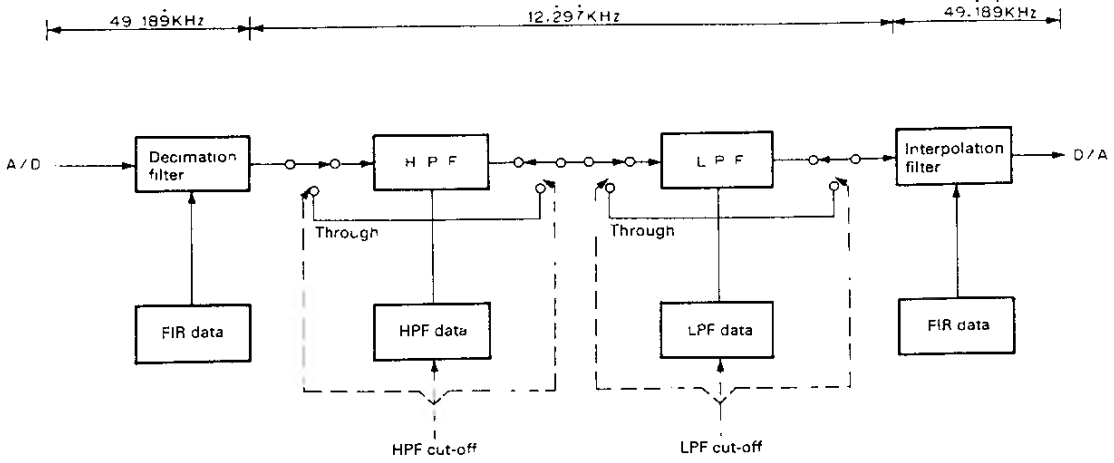


Fig. 55 AF SLOPE TUNE block diagram

CIRCUIT DESCRIPTION

· Overview of processing

The digital audio signal from the A/D converter is converted into 1/4 the sampling frequency by the decimation filter, and is then processed by the high-pass and low-pass filters. The signal is then returned to the original sampling frequency by the interpolation filter, and transmitted from the D/A converter.

· Functions

The decimation filter and interpolation filter are composed of 20th degree FIR filters.

The high-pass filter is a simultaneous 4th order Chebeshev filter. The low-pass filter is a simultaneous 6th order Chebeshev filter.

The ripple bandwidth of the high-pass filter is 0.1 dB, and that of the low-pass filter is 0.0001 dB. These characteristics assure flat frequency characteristics and reduce variations in the group delay characteristics near the cut-off frequency.

The sampling frequencies for the high-pass filter and low-pass filter are reduced by 1/4 to shorten the processing time. This helps provide ample processing time for both the high-pass filter and low-pass filter and improves performance.

The cut-off frequencies of the high-pass filter and low-pass filter are controlled according to data from the main unit, and operate interlocked with the slope tune controls of the main unit. The bandwidth can be narrowed by two clicks with the SLOPE TUNE control on the main unit by operating the DSP-10 switch.

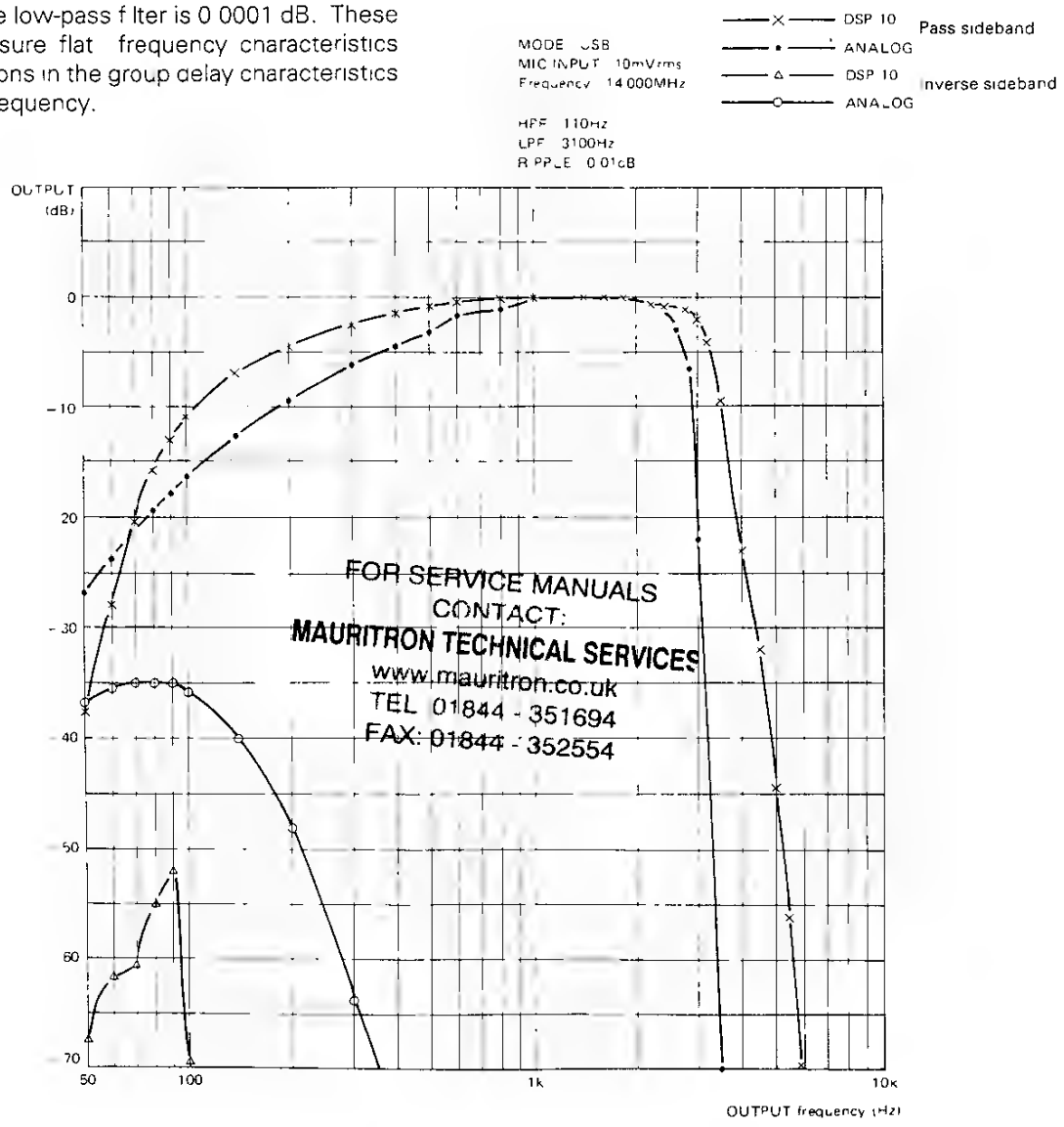


Fig. 56 TS-950SD SSB frequency response

CIRCUIT DESCRIPTION

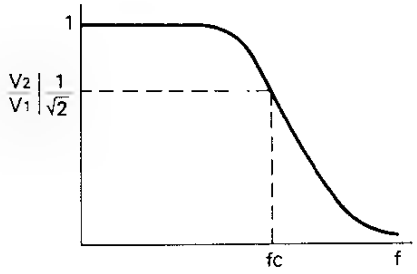
- **Reference data**

1) Butterworth characteristic

The ratio of input voltage V1 and output voltage V2 is given by the equation (1).

$$\left|\frac{V_2}{V_1}\right| = \frac{1}{\sqrt{1+(f/fc)^6}} \quad \cdots\cdots (1)$$

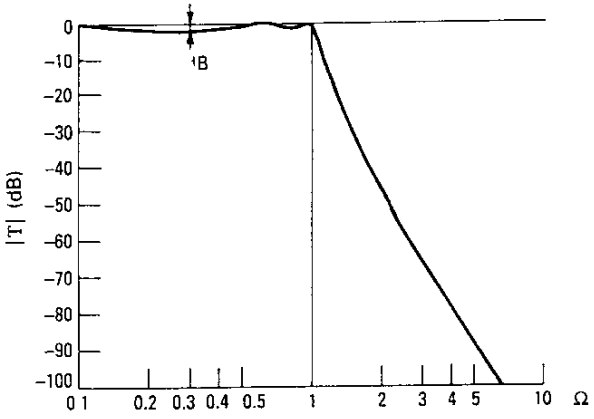
V2/V1 becomes (1) when f < fc and decreases when f > fc. As the figure below shows, this functions as a low-pass filter with fc as a boarder. This is called the Butterworth characteristic and is representative of filter characteristics. The fc is called a cutoff frequency.



Low-pass characteristic

2) Tchebycheff characteristic

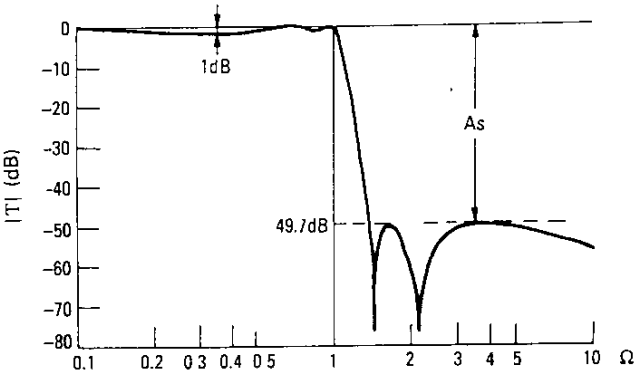
A Butterworth characteristic has a flat response in the passband, but can have a sharp cutoff when the passband contains ripple. A characteristic that contains an equal ripple in the passband is called a Tchebycheff characteristic. The maximum cutoff can be obtained with respect to the ripple in the given passband. The amplitude of a five-degree Tchebycheff characteristic having 1 dB of ripple in the band is shown in the figure below.



Amplitude of five-degree Tchebycheff characteristic

3) Simultaneous Tchebycheff characteristic

All amplitudes of the characteristics described above decrease when attenuation decreases. At that time, the transfer function is represented by the reciprocal of a polynomial expression. When the numerator of the transfer function is also represented by a polynomial expression and transmission zero points are set to some attenuation bands, an even sharper cutoff can be obtained. A characteristic that contains equal ripple in the passband and attenuation band is called a simultaneous Tchebycheff caracteristic. The sharpest cutoff characteristic can be obtained with respect to the given degree, allowable ripple in the passband, and minimum attenuation in the attenuation band. The five-degree amplitude characteristic when the ripple in the passband is 1 dB and minimum attenuation, as in the attenuation band is approximately 50 dB as shown below.



Amplitude of simultaneous Tchebycheff characteristic

4) Nyquist band

When a signal is sampled using sampling frequency fs in accordance with the sampling theorem, sampled signal f (t) can be reproduced by interpolating a sampled signal if its band is 1/2 fs. A band of 1/2 fs is called the Nyquist band.

5) Transition band characteristic

This indicates the situation in which the band transits from passband to stopband.

6) IIR LPF (IIR filter)

This is suitable for manufacturing a filter having a sharp cutoff. This filter can be designed by converting the transfer function of an analog filter.

7) FIR filter

This filter has a perfectly linear phase, stable operation, and improved singal-to-noise ratio (SNR).

8) Decimation filter

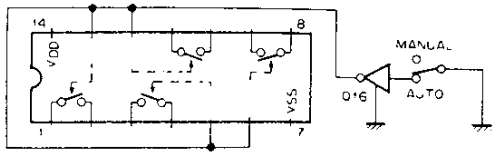
This filter is used to decimate data when a signal is converted to a low sampling frequency.

9) Interpolation filter

This filter is used to interpolate data when a signal is converted to a nigh sampling frequency.

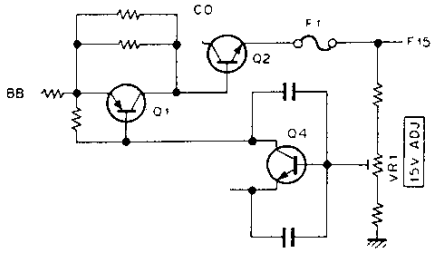
DESCRIPTION OF COMPONENTS

SWITCH UNIT (A) (X41-3080-00)

Components	Use/Function	Operation/Condition/Compatibility
IC1	AT AUTO/MAMU signal select	
IC2	One shot-multi vibrator.	For dimmer adjust.
Q1	FM LED driver	LFM (CN6). Active 'H'
Q2	AM LED driver	LAM (CN6). Active "H"
Q3	CW LED driver	LCW (CN6) Active "H"
Q4	USB LED driver	LUSB (CN6) Active 'H'
Q5	LSB LED driver	LLSB (CN6) Active 'H'
Q6	FSK LED driver	LFSK (CN6) Active "H"
Q7	TA LED driver	LTA (CN6). Active 'H'
Q8	RM LED driver	LRM (CN6). Active 'H"
Q9	RA LED driver	LRA (CN6). Active "H'
Q10	TM LED driver	LTM (CN6) Active 'H'
Q11	TB LED driver	LTB (CN6). Active 'H"
Q12	RB LED driver	LRB (CN6) Active 'H'
Q13~15	Key pad LED driver	LK1 (CN6) Active "H'
Q16	Driver	Analog gate (IC1) select
Q17	Buffer	
D1~7	Reverse current prevention	
D8	AIP LED	HIPC (CN1). Active "L"
D9	NOTCH LED	LNOT (CN1). Active 'H'
D10	AT TUNE LED	LMTA (CN1) Active 'H"
D11	ON AIR LED	LTXB (CN1) Active "H'
D12	D8 protection	D12 get to reverse bias when HPC become 'H"
D13	AVR	+10V
D14	Reverse current prevention	

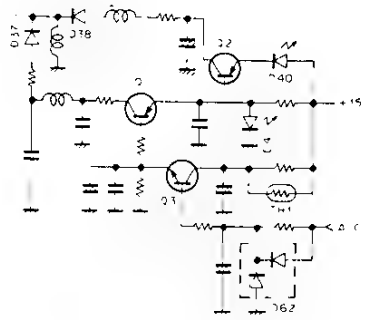
AVR UNIT (X43-3070-01) (A/6) ~ (E/6)

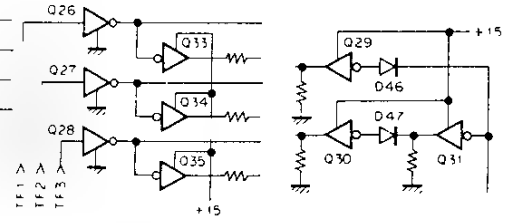
Components	Use/Function	Operation/Condition/Compatibility
IC1	+5V AVR	+5V voltage supply for digital unit.
IC2	+5V AVR	+5V voltage supply for PLL unit.
IC3	+5V AVR	+5V voltage supply for DSP unit.
IC4	–12V AVR	–12V voltage supply for each PC board
Q1	Pre drive	Drive to Q2 device
Q2	Series-passed transistor	+15V voltage supply for each PC board.
Q3	Fan motor "HIGH" switch	Fan motor turned to "HIGH" position
Q4	An error amplifier	Amplified voltage error of the +15V voltage supply
Q5	–40V AVR	–40V voltage supply for FL tube.
D1	Voltage rectifier	Base bias for Q1
D2	Temperature compensation	Cancel to D1 voltage change from temperature changing
D3	+15V AVR reference voltage	+7.5V.
D4	Fan turned start voltage	Make a voltage when the fan turned on.
D5	Voltage rectifier	–40V.
D6	Voltage rectifier	–12V
D7,8	Occur –40V voltage	–20V x 2.
D9	Voltage rectifier	+58V voltage for final unit.
D10	Voltage rectifier	+15V



DESCRIPTION OF COMPONENTS

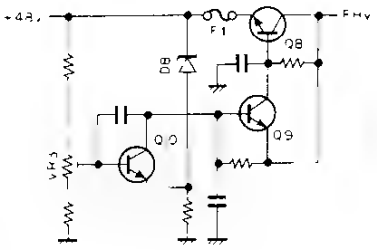
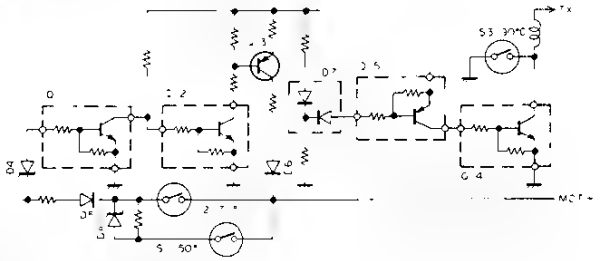
RF UNIT (X44-3100-00)

Components	Use/Function	Operation/Condition/Compatibility
IC1,2	Band information decoder	Open collector Active "L"
Q1~3	RF AGC amplifier	
Q4	AIP amplifier	
Q5,6	RF amplifie	
Q7	Buffer	
Q8~11	RX SUB 1st mixer	Convert receive frequency into 40.055MHz
Q12	Buffer	
Q13~16	RX MAIN 1st mixer	Convert receive frequnecy into 73.05MHz.
Q17	SUB VCO amplifier	
Q18	MAIN VCO amplifier	
Q19	TX DRIVE amplifier	RF output of RF unit 10dBm or more
Q20,21	TX 3rd mixer	Convert 73.05MHz into transmission frequency
Q22	TX amplifier	
Q23	Switching	When RB3 become "H" output to "L"
Q24	Switching	On in MONITOR operation
Q25	Switching	On in AT TUNE
Q26~28	Switching	Transmission filter select
Q29~31	Switching	AIP turned on and off select
Q32	Switching	On in MONITOR operation
Q33~35	Switching	Bias of mixer circuit select
Q37	Switching	ATT in MONITOR operation
D1,2	Relay surge voltage absorption	D1 10dB ATT, D2 20dB ATT
D3	Voltage regulator	Voltage supply of IC1 and C2 (5V)
D4,5	Lightning surge protection	
D6~35	RX BPF select	
D36	Switching	MARKER circuit switch
D37,38	AF AGC	AGC circuit pin diode
D39	Switching	Frequency range 0.5MHz ess and more select
D40	Voltage shift	
D41	Voltage regulator	
D42~45	Switching	AIP turned on and off select.
D46,47	Reverse current prevention	
D48,49	Switching	MONITOR turned on and off
D50,51	Switching	MAIN VCO transmission and receive select
D52~57	Switching	TX BPF select
D58~60	Reverse current prevention	TX mixer circuit bias.
D61	Reverse current prevention	Decide to gain of the POWER CONTROL or AT TUNE
D62	Reverse current prevention	
D63	Lightning surge protection	
D64	Switching	MARKER circuit switching.

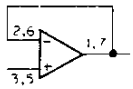


DESCRIPTION OF COMPONENTS

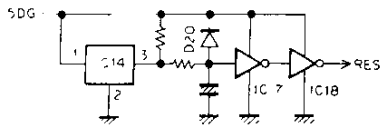
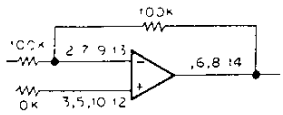
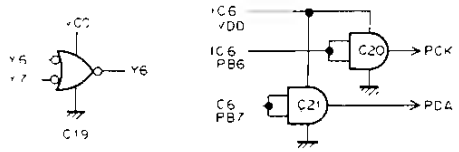
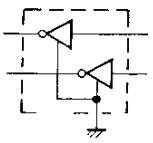
FINAL UNIT (X45-3330-00)

Components	Use/Function	Operation/Condition/Compatibility
Q1	Pre-drive amplifier	HF wide range amplifier
Q2,3	Driver amplifier	Pushpull wide range amplifier
Q4,5	Final amplifier	Pushpull wide range amplifier
Q6	Drive bias voltage supply	
Q7	Final bias voltage supply	
Q8~10	AVR	Final +48v 
Q11~13	Switching	Fand motor control
Q14,15	Switching	Transmission stop when irregular voltage of 50V 
D1	Temperature compensation	Pre-driver temperature detection
D2	Temperature compensation	Drive temperature detection
D3	Temperature compensation	Final temperature detection
D4	15V voltage detection	
D5,6	Reverse current prevention	
D7	Switching	Transmission stop when irregular voltage of 50V
D8	AVR	50V AVR reference voltage
D9	Surge absorption	For fan motor
D10	AVR	Voltage drop protection when S1 switch turned on

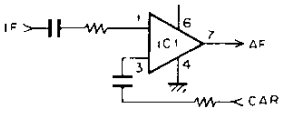
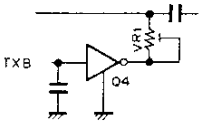
DIGITAL UNIT (X46-3050-XX) -11 : K,P -21 : M -61 : W -62 : W2 -71 : X

Components	Use/Function	Operation/Condition/Compatibility
IC1	CPU	8 bit micorprocessor
IC2	ROM	32K x 8 bit
IC3	RAM	8K x 8 bit
IC4	Address latch	Multiplexer address/address latch of data output
IC5	Address decoder	Convert address signal into each IC chip select signal
IC6	I/O port	8 bit x 4, 4 bit x 1.
IC7	I/O port	8 bit x 6
IC8	I/O port	8 bit x 4, 4 bit x 1
IC9	Encoder gate array	MAIN, CLICK count of the encoder
IC10	Encoder gate array	SUB, RIT/XIT count of the encoder
IC11	Buffer	D/A converter output. 
IC12	Inverter	Encoder shape wave circuit
IC13	A/D converter	8 bit, 8 channel.

DESCRIPTION OF COMPONENTS

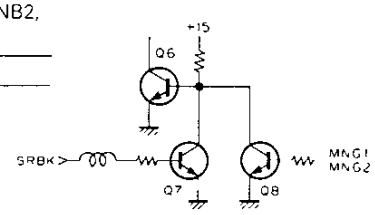
Components	Use/Function	Operation/Condition/Compatibility
IC14	System reset	Reset pulse generator 
IC15	Serial buffer	Parsonal computer interface I/O buffer
IC16	Buffer	D/A converter output 
IC17,18	Reset buffer	Reset signal buffer
IC19	Chip select decoder	Chip select mixer for RAM
IC20	Data buffer	PLL clock pulse buffer
C21	Data buffer	PLL data pulse buffer 
Q1	Mode signal switching	DATA mode, FSK mode
Q2	Mode signal switching	AM mode, CW mode
Q3	Mode signal switching	FM mode, SSB mode 
Q4	Signal switching	AIP signal (mixer select), ALMS signal (MET3 meter select)
Q5	TXI signal switching	Transmission band indication signal
Q6,7	RX band signal switching	RB0 ~ RB3
Q8,9	LPF signal switching	LP0 ~ LP3
Q10	APRE signal switching	AT preset signal
Q11	SMKC signal switching	Sub marker signal turn on and off Marker on active
D1,4	Back-up voltage select switch	
D2,3	Protection diode	M C UP/DOWN .
D5	Switching	Antenna tuner auto/through signal
D6,7	Switching	Option filter D.S switch
D8~11	Protection diode	A/D converter input protection
D12	Switching	Expand frequency function
D14,15	Switching	Expand frequency function
D17~19	Switching	Expand frequency function
D20	Reset diode	Reset circuit time constant capacitor discharge

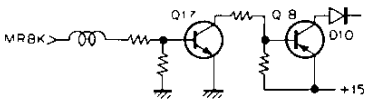
IF UNIT (X48-3060-00)

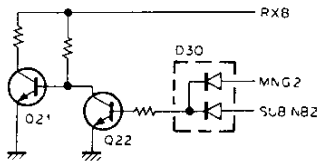
Components	Use/Function	Operation/Condition/Compatibility
IC1	SUB receive detection	Convert IF 10.695MHz into AF level 
Q1	SUB IF amplifier	40.055MHz
Q2,3	SUB 2nd mixer	40.055MHz → 10.695MHz
Q4	Switching	On in transmit mode 

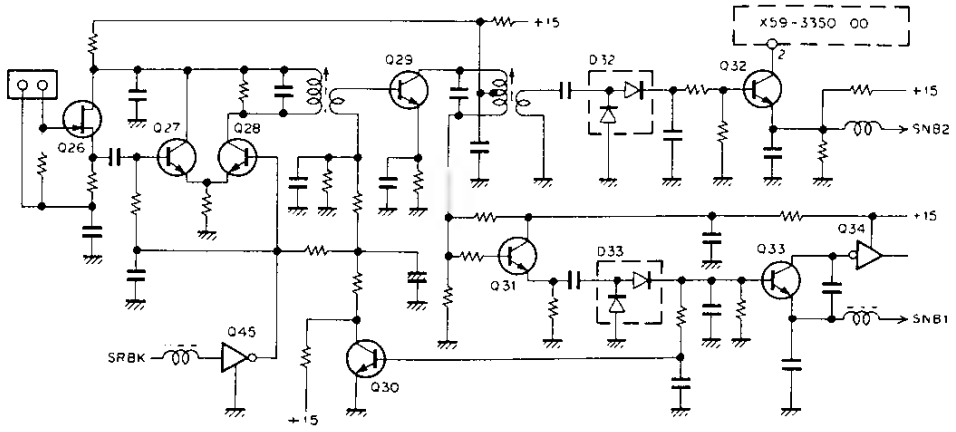
DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
Q5	SUB IF amplifier, NB gate	10.695MHz
Q6	Switching	Turned off when MAIN and SUB NB1, NB2, and SRBK pulse occur
Q7	Switching	Turned on when SRBK pulse occur
Q8	Switching	Turned on when MAIN and SUB NB1, NB2 pulse occur
Q9,10	SUB IF amplifier	10.695MHz
Q11	Buffer	10.695MHz AGC
Q12	SUB AGC amplifier	
Q13	SUB 2nd local amplifier	50.75MHz
Q14	MAIN IF amplifier	73.05MHz
Q15,16	MAIN 2nd mixer	73.05MHz → 8.83MHz
Q17,18	Switching	Turned on when MRBK pulse occur
Q19,20	MAIN 3rd mixer	8.83MHz → 455kHz
Q21	Switching	Turned off when MNG2 and SUB NB2 pulse occur
Q22	Switching	Turned on when MNG2 and SUB NB2 pulse occur
Q23	Buffer	73.05MHz for F OUT 1
Q24	Mixer	73.05MHz → 8.83MHz for F OUT 1
Q25	Amplifier	64.22MHz
Q26	Buffer	10.695MHz for SUB NB
Q27~29	Amplifier	10.695MHz for SUB NB
Q30	AGC amplifier	SUB NB
Q31	Buffer	SUB NB1
Q32	Switching	SUB NB2
Q33,34	Switching	SUB NB1

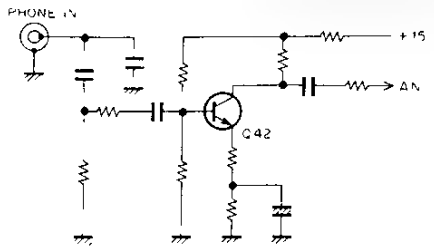








DESCRIPTION OF COMPONENTS

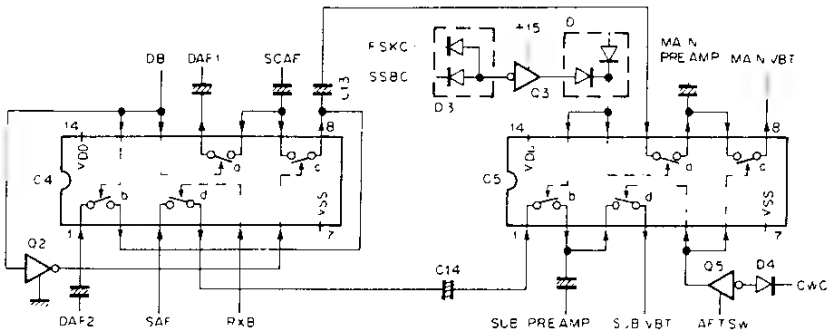
Components	Use/Function	Operation/Condition/Compatibility
Q35	Sw tch ng	SUB NB2
Q36,37	TIF 2nd mixer	8 83MHz → 73 05MHz
Q38	IF amplif er	8 83MHz ALC
Q39	Loca amplif.er	9 285MHz
Q40	F amp fier	8 83MHz
Q41	T F 1st mixer	455kHz → 8 83MHz
Q42	AF amplifier	Phone patch 
Q44	Buffer	73 05MHz.
Q45	Switching	Turned on when SRBK pu se occur
D1,2	Switching	SUB NB
D3	SUB AGC detection	
D4	Reverse current prevent on	MAIN AGC
D5~8	NB gate	
D9	Voltage regu ator	NB gate
D10	Reverse current prevent.on	NB gate
D11	Reverse current prevention	MAIN NB and SUB NB pu se synthes s
D12	Switching	On n receive mode
D13~17	Switching	Filter se.ect
D18	Switching	On in transm.t mode
D19~27	Switching	F ter select
D28,29	Switching	On in receive mode.
D30	Reverse current prevention	NB2.
D31	Switching	On in transmit mode
D32	Noise blanker detection	SUB NB2
D33	Noise blanker detection	SUB NB1
D34	Reverse current prevention	CKY
D35	Voltage regulator	CKY
D36	Voltage sh ft	CKY
D37,38	Switch ng	On n transmit mode
D39	Switching	On in receive mode
D40	Relay surge absorpt on	Linear amplifier re ay
D41,42	Voltage shift	Linear amplifier relay.
D43	Reverse current prevention	PSQ

AF UNIT (X49-3020-00)

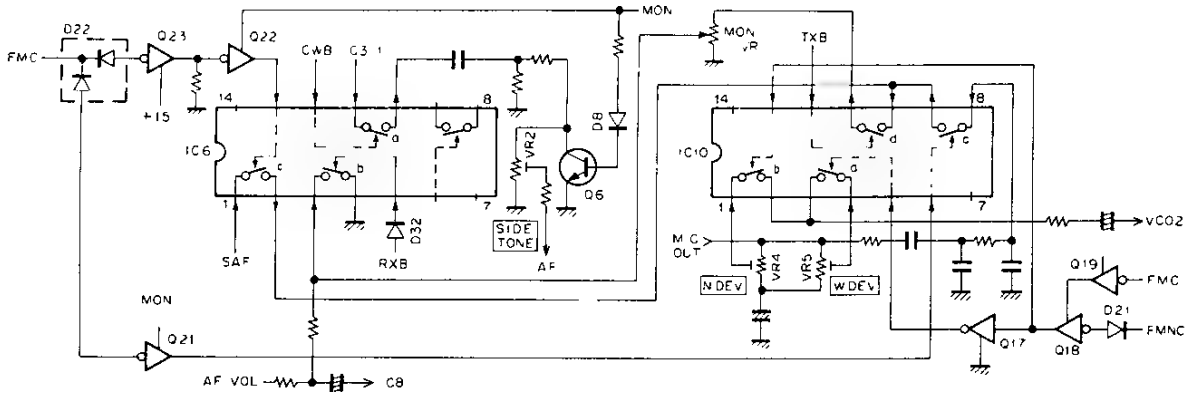
Components	Use/Function	Operation/Condition/Compatibility
IC1	D vider (2 x 1/10)	AF VBT c ock and sidetone frequency occur
IC2	Sw tched capac tor f..ter x 2	MAIN and SUB AF VBT
IC3	Switched capacitor filter x 1	Sidetone f lter
IC4 (a/4)	AF select switch	On n DSP mounted (MAIN SSB and CW).
IC4 (b/4)	AF select switch	On in DSP mounted (MAIN SSB and CW)
IC4 (c/4)	AF select switch	On in DSP re-mounted (MAIN SSB and CW)
IC4 (d/4)	AF select switch	On n receive mode (SUB AF)
IC5 (a/4)	AF select switch	On in CW AF VBT operat on (When MA N are not using to AF VBT)
IC5 (b/4)	AF select switch	On in CW AF VBT operation (When SUB are not using to AF VBT)

DESCRIPTION OF COMPONENTS

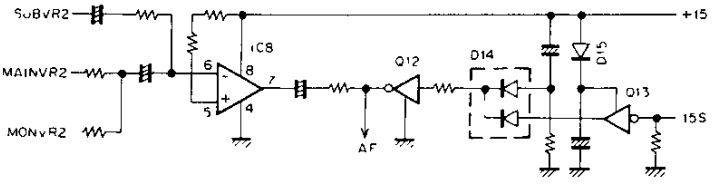
Components	Use/Function	Operation/Condition/Compatibility
C5 (c/4)	AF select switch	On in CW AF VBT operation (When MAIN are using to AF VBT)
IC5 (d/4)	AF select switch	On in CW AF VBT operation (When SUB are using to AF VBT)



IC6 (a/4)	Sidetone ON and OFF switch	On in CW mode
IC6 (b/4)	Monitor AF short switch	Receive mode or MON TOR switch is turned off Short
IC6 (c/4)	AF select switch	On without FM mode (AF for monitor without FM mode)
IC6 (d/4)		Unused

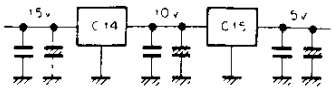
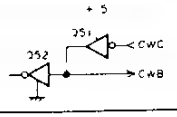


IC7 (a/2)	AF amplifier	MAIN AF
IC7 (b/2)	AF amplifier	SUB AF
IC8 (a/2)	AF amplifier	MAIN, SUB, and MONITOR mixing
IC8 (b/2)		Unused.



IC9	One shot multi vibrator	Make a vox delay time. 3 CD (Input) 4 A (Input), GND 5 B (Input) 6 Q (Output)
IC10 (a/4)	FM MIC amplifier output select switch	On in FM WIDE mode.
IC10 (b/4)	FM MIC amplifier output select switch	On in FM NARROW mode
IC10 (c/4)	AF select switch	On in FM MONITOR mode (AF for FM monitor)
IC10 (d/4)	AF select switch	On in transmit mode (AF mofitor)
C11	PLL1 (MAIN LO1) (500kHz step 30MHz coverage)	2,3,4 : Divided ratio setting input 5 10MHz input 7 LOCK voltage output 8 UNLOCK output, when unlocked "H". 11 . 38~68MHz input.
IC12	Mixer (MIX1)	5 : 73.06~103.05MHz input 11 35.05~35.55MHz input. 13 : 38~68MHz output

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
IC13	PLL0 (MAIN LO2)	2,3,4 Divided ratio setting input 5 10MHz input. 7 LOCK voltage output 8 UNLOCK output, when unlocked "H" 12 64.22MHz input
IC14	AVR	10V (in the AF unit)
IC15	AVR	5V (in the AF unit) 
Q1	AFT amplifier	80kHz ± 50kHz
Q2	Switching	On when DSP installed
Q3	Switching	On in FSK or SSB mode
Q4	Switching	On in AF VBT operation
Q5	Switching	On in CW mode
Q6	Muting	On when no sidetone output
Q7	Muting	On when insert a key plug into jack
Q8	Muting	On in transmit, MABK and SQ mode (MAIN mute)
Q9	Muting	On in transmit, SABK and SQ mode (SUB mute)
Q10	AF amplifier	MAIN REC OUT
Q11	AF amplifier	SUB REC OUT
Q12	Muting	When power switch is turned on or off, mute in TX/RX
Q13	Switching	On for instant when power switch is turned on
Q14	Switching	On in CW and FSK mode
Q15	AF amplifier	For sub tone
Q16	Muting	On in receive mode (Muted to FM MOD line when receive mode)
Q17,18	Switching	On in FM NARROW mode
Q19	Switching	On in FM mode
Q20	AF amplifier	FM MIC signal.
Q21	Switching	On in FM mode
Q22	Switching	On in FM mode
Q23	Switching	On in FM mode
Q24	Switching	VCO select (10kHz~7.5MHz on).
Q25	Switching	VCO select (7.5MHz~14.5MHz on)
Q26	Switching	VCO select (14.5MHz~21.5MHz on)
Q27	Switching	VCO select (21.5MHz~30MHz on)
Q28	Switching	UNLOCK detection (PLL0, 1)
Q29~31	PLL1 low-pass filter	Active filter (Reference frequency 500kHz)
Q32	VCO1 output amplifier	73.06MHz~103.05MHz
Q33	MIX1 input buffer	73.06~103.05MHz
Q34,35	MIX1 output buffer	38MHz~68MHz
Q36	MIX1 input buffer	35.05MHz~35.55MHz (MAIN LO1)
Q37	MAIN LO1 output buffer	73.06MHz~103.05MHz.
Q38	REF buffer	10MHz (Reference of PLL IC)
Q39	MAIN LO2 output buffer	64.22MHz
Q40	Buffer	8.83MHz for MAIN NB
Q41,42	Amplifier	8.83MHz for MAIN NB.
Q43	AGC amplifier	8.83MHz for MAIN NB.
Q44	Amplifier	8.83MHz for MAIN NB
Q45	Buffer	MAIN NB1
Q46	Switching	MAIN NB2
Q47,48	Switching	MAIN NB1.
Q49	Switching	MAIN NB2.
Q50	Switching	On in MONITOR operation
Q51	Switching	On in CW mode (CWB)
Q52	Switching	On in CW mode. 

DESCRIPTION OF COMPONENTS

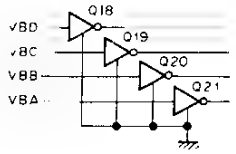
Components	Use/Function	Operation/Condition/Compatibility
D1,2	Reverse current prevention	
D3	Reverse current prevention	FSKC, SSBC
D4	Reverse current prevent on	CWC
D5~8	Reverse current prevent on	
D9	Reverse current prevention	KEY
D10	Reverse current prevention	
D11	Reverse current prevention	RBC,SABK.
D12	Reverse current prevent on	RBC, SQ
D13	Reverse current prevent on	MABK
D14,15	Reverse current prevention	
D16	Reverse current prevention	VOXD_
D17	Reverse current prevention	
D19	Reverse current prevent on	FSKC,CWC
D21	Reverse current prevent on	FMNC
D22	Reverse current prevention	
D23	Reverse current prevention	VBC, VBD
D24	Voltage regulator	VCO1
D25,26	Reverse current prevention	UNLOCK signal
D27	Voltage regulator	VCO0
D28,29	NB detection	NB2
D30	NB detection	NB1
D31	Reverse current prevent on	MONITOR
D32	Reverse current prevention	RXB
D33	Reverse current prevention	

PLL UNIT (X50-3100-00)

Components	Use/Function	Operation/Condition/Compatibility
IC1	AVR	8V (PLL and CAR unit)
IC2	PLL3 (MAIN LO1) (10Hz step with 10kHz coverage)	2,3,4 Divided ratio setting input 5 . 10MHz input. 7 LOCK voltage output. 8 UNLOCK output, When unlocked 'H' 11 58~56MHz input.
IC3	Divider (1/20)	4 : 58~56MHz input 8 . 2.9~2.8MHz output
IC4	Mixer (MIX4)	1 12.9~12.8MHz output 2 2.9~2.8MHz input 5 : 10MHz input
IC5	Mixer (MIX3)	1 36.6~31.7MHz output 2 12.9~12.8MHz input 5 49.5~44.5MHz input
IC6	PLL2 (MAIN LO1) (10kHz step with 500kHz coverage)	2,3,4 Divided ratio setting input 5 10MHz input 7 LOCK voltage output 8 UNLOCK output, when unlocked 'H' 11 . 36.6~31.7MHz input
IC7	Divider (1/10)	1 49.5~44.5MHz input. 4 4.95~4.45MHz output.
IC8	Mixer (MIX2)	1 35.05~35.55MHz output 2 4.95~4.45MHz input 5 40MHz input
IC9 (1/2)	Divider (1/2)	5 20MHz input 9 : 10MHz output
IC10	PLL8 (SUB LO1)	2,3,4 Divided ratio setting input 5 10MHz input 7 LOCK voltage output 8 : UNLOCK output, when unlocked 'H' 11 109~107MHz input
IC11	Divider (1/20)	4 109~107MHz input 8 5.45~5.35MHz output.
IC12	Mixer (MIX12)	1 . 25.45~25.35MHz output 2 5.45~5.35MHz input 5 : 20MHz input.
IC13	Divider (1/10)	1 25.45~25.35MHz input 4 2.545~2.535MHz output.
IC14	Mixer (MIX11)	1 12.545~12.535MHz output 2 2.545~2.535MHz input 5 : 10MHz input
IC15	Mixer (MIX10)	1 : 38.205~38.215MHz output 2 12.545~12.535MHz input. 5 50.75MHz input.
IC16	Mixer (MIX9)	1 1.86~31.85MHz output 2 38.205~38.215MHz input 5 40.065~70.055MHz input.
IC17	PLL7 (SUB LO1) (10kHz step)	2,3,4 Divided ratio setting input 5 10MHz input 7 : LOCK voltage output. 8 UNLOCK output, when unlocked 'H' 11 : 1.86~31.85MHz input.
IC18 (1/2)	PLL7 LPF	10kHz~7.5MHz active filter (Reference frequency 10kHz).
IC18 (2/2)	PLL7 LPF	7.5MHz~30MHz active filter (Reference frequency 10kHz).
Q1	MIX4 input buffer	10MHz.

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
Q2	M X3 input buffer	49 5~44 5MHz
Q3	P_L2 IC nput amplif.er	36 6~31 7MHz
Q4	Doubler	40MHz
Q5	MAIN ocal output buffer	35 05~35 55MHz (PL_1 loop)
Q6	TTL input amplif.er	20MHz
Q7	MIX12 .nput buffer	20MHz
Q8	M X11 input buffer	10MHz.
Q9	MIX10 input buffer	50 75MHz
Q10	MIX9 input buffer	40 065~70 055MHz
Q11,12	P_L7 C input buffer	1 86~31 85MHz
Q13	VCO7 output amp fier	40 065~70 055MHz
Q14	SUB LO1 output buffer	40 065~ 70 055MHz
Q15	OSC2	50 75MHz (SUB LO2)
Q16	OSC2 buffer	
Q17	SUB LO2 output buffer	50 75MHz
Q18	Switching	VCO select (21 5~30MHz on)
Q19	Switch ng	VCO se ect (14 5~21 5MHz on)
Q20	Switching	VCO select (7 5~14 5MHz on)
Q21	Switch ng	VCO select (10kHz~7 5MHz on)
Q22	Switching	UNLOCK detect on (PLL2,3,4,5,6,9)
Q23	Switching	UNLOCK detection (PLL7,8)
D1	Reverse current prevent on	UNLOCK signa
D2	VCO3 frequency adjustab e	
D3	Reverse current prevent on	UNLOCK s gnal
D4	VCO2 frequency adjustab e	
D5	Reverse current prevent on	UNLOCK s gnal
D6	VCO7 frequency adjustab.e	
D7	Voltage regulator	VCO7
D8	Reverse current prevention	UNLOCK signal
D9	Voltage regulator	OSC2



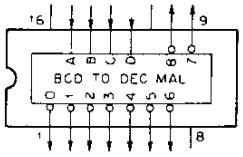
CAR UNIT (X50-3110-XX) -00 : S -01 : SD

Components	Use/Function	Operation/Condition/Compatibility
IC1	PLL5 (MAIN LO4)	2,3,4 D v ded ratio setting .nput 5 10MHz input. 7 LOCK voltage output. 8 UNLOCK output, when un ocked H' 11 35 5MHz input
IC2	Divider (1/100)	4 35 5MHz input 8 355kHz output
IC3	PLL6 (MAIN LO3)	2,3,4 Divided rat o setting input 5 10MHz input 7 LOCK voltage output. 8 UNLOCK output, when unlocked "H " 11 71 5MHz nput
IC4	Divider (1/100)	4 71 5MHz input 8 715kHz output
IC5	Mixer (MIX7)	1 . 9.285MHz output 2 715kHz input. 5 · 10MHz input.
IC6	P_L4 (MA N and SUB CAR)	2,3,4 . Divided rat o setting input 5 10MHz input 7 _OCK voltage output 8 UNLOCK output, when unlocked "H " 11 69 5MHz .nput
IC7	Div der (1/100)	4 69 5MHz input 8 695kHz output
IC8	Mixer (MIX13)	1 10 695MHz output 2 695kHz .nput 5 10MHz input
IC9	PL_9 (MAIN CAR)	2,3,4 Divided ratio sett ng input. 5 10MHz .nput 7 : LOCK voltage output. 8 UNLOCK output, when unlocked H" 11 : 59 5MHz input
IC10	Mixer (MIX5)	1 10MHz output. 2 59 5MHz input 5 69 5MHz input
IC11	Mixer (MIX8)	When CW PITCH 800Hz 1 80kHz output 2 9 92MHz input 5 10MHz input
IC12	Div der (1/100)	4 10MHz .nput 8 100kHz output
IC13	PLL (EXT STD)	9 1MHz .nput. 13 LOCK voltge output 14 10kHz input

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
IC14	Divider (1/2, 1/5)	1 10MHz output 11 2MHz output 12 10MHz input 14 20MHz input
IC15 (1/2)	Divider (1/2)	1 1MHz output 3 2MHz input
IC15 (2/2)	Divider (1/2)	11 4.26kHz input 13 2.128kHz output
IC16	Divider (Programmable)	1 4.26kHz output 3~6,11~14 Divided ratio setting input 7 Enable FSK "H" 9 1MHz input
IC17 (1/2)	2 line-4 line decoder	1 Enable "H" on 2,3 AFSK space frequency setting input 4~7 Divided ratio setting output (space)
IC17 (2/2)	2 line-4 line decoder	9,12 Divided ratio setting output (mark) 10,11 Mark, space select output 13 Key pole output 14 Shift (FWD, REF) select input
Q1	MAIN LO4 output buffer	355kHz
Q2	MIX7 input buffer	10MHz
Q3	MAIN LO3 output amplifier	9.285MHz
Q4	MIX13 input buffer	10MHz
Q5	SUB CAR output amplifier	10.695MHz
Q6	MIX5 input buffer	59.5MHz
Q7	MIX5 input buffer	69.5MHz
Q8	MIX8 input buffer	9.92MHz when CW PITCH 800Hz
Q9	MIX8 input buffer	10MHz
Q10	AFT output buffer	30~150kHz in CW mode
Q11	MAIN CAR output buffer	100kHz.
Q12	EXT STD buffer	10kHz
Q13	OSC1	20MHz (STD)
Q14	OSC1 buffer	SO-2 buffer when SO2 operates
Q15	TTL input amplifier	20MHz
Q16	REF output amplifier	20MHz (PLL unit)
Q17	REF output amplifier	10MHz (AF unit)
Q18	REF output amplifier	10MHz (DSP unit)
Q19	AFSK output buffer	2.125kHz (Active low-pass filter)
D1	Reverse current prevention	UNLOCK signal
D2	VCO5 frequency adjustable	
D3	Reverse current prevention	UNLOCK signal
D4	VCO6 frequency adjustable	
D5	Reverse current prevention	UNLOCK signal
D6	VCO4 frequency adjustable	
D7	Reverse current prevention	UNLOCK signal
D8	VCO9 frequency adjustable	
D9	VCXO frequency adjustable	OSC1
D10	Voltage regulator	OSC1
D11~13	Reverse current prevention	AFSK divided setting matrix and mark, space select.
D14	Reverse current prevention	

FILTER UNIT (X51-3060-XX) -00 : TS-950SD (K,M,W,X,P) -01 : TS-950S (K,M,W,X,P) -61 : TS-950S (W2) -62 : TS-950SD (W2)

Components	Use/Function	Operation/Condition/Compatibility
IC1	Band data decoder	
IC2	Relay driver	
IC3	AVR	+5V
Q1	Relay driver	10F relay
D1	Relay surge absorption	1.6~2.5MHz LPF relay

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
D2	Relay surge absorption	2 5~4 0MHz LPF relay
D3	Relay surge absorption	4 0~7 5MHz LPF relay
D4	Relay surge absorption	7 5~10 5MHz LPF relay
D5	Relay surge absorption	10 5~14 5MHz LPF relay
D6	Relay surge absorption	14 5~21 5MHz LPF relay
D7	Relay surge absorption	21.5~30MHz LPF relay
D8	RF rectifier	REF rectifier
D9	RF rectifier	FWD rectifier
D10	Relay surge absorption	Transmit/receive select relay
D11	LPF select	18, 21MHz
D12	LPF select	25, 28MHz
D13,14	Level shift	12V relay drive
D15	Lightning surge protection	RAT terminal surge absorber

CONTROL UNIT (X53-3230-00)

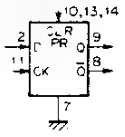
Components	Use/Function	Operation/Condition/Compatibility
IC1	Inverter	1-2, 3-4, 5-6, 12-13 : FULL, VOX 2-9, 10-11 Pulse delay
IC2	NAND gate	1-2-3 : CKY 11-12-13 VOX, FULL
IC3	Analog switch	VOX, FULL
IC4	Analog switch	1-2-13, 3-4-5 CKY
C5	Inverter	8-9, 10-11, 12-13 CKY
IC6	NAND gate	1 2-3 CKY 4-5-6 RBC
IC7	Audio amplifier	
IC8	Operational amplifier	ALC and IC meter
IC9	Analog switch	Meter select
IC10	One shot multivibrator	2-3-4-5-7 CKY timing 10-11-12-13-14 16 Semi-breakin timing
IC11	Operational amplifier	1-2-3 Power meter
IC12	3-terminal AVR	nput 15V Output 8V
IC13	Inverter	1-2, 3-4 Pulse delay
IC14	Electronic key controlled CPU	
IC15	NAND gate	Electronic key speed oscillator
Q1	ALC amplifier	
Q2	Amplifier	SWR protection amplifier
Q3	Amplifier	IC protection amplifier
Q4	Voltage shift	ALC meter voltage occur
Q5	Buffer	ALC voltage control
Q6	Switching	Meter select (ALC/Ic)
Q7	Switching	Stand-by control
Q8	switching	VOX
Q9	Switching	Discharge
Q10,11	Differential amplifier	ALC amplifier
Q12	Switching	RF output drop
Q13~16	Switching	AT tune
Q17	Switching	KEY
Q18	Switching	FULL
Q19	Switching	Reset
D1	Reference voltage	1.8V
D2,3	Voltage shift	EXT ALC
D4	Temperature compensation	IC protection
D5	Voltage shift	4 7V
D6	Voltage shift	ALC
D7	Reverse current prevention	ALC
D8	Reference voltage	4 7V

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
D9	Discharge	
D10	Switching	Transmission and automatic antenna tuner
D11	Switching	AT and keying
D12	Over load prevention	
D13	Reverse current prevention	
D14	Surge voltage absorption	
D15,16	Switching	Transmit signal
D17	Switching	CKY
D18	Reverse current prevention	
D19	Surge voltage absorption	
D20	Switching	CWB
D21	Switching	KEY
D22	Switching	Transmit
D23	Switching	ATS and KEY
D24	Switching	Transmit
D25	Switching	KEY
D26	Switching	Transmit
D27	Switching	CW semi break in and delay
D28	Switching	Temperature RF output drop
D29	Switching	28MHz RF output drop
D30	Switching	AT
D31	Reverse current prevention	Keying dot
D32	Reverse current prevention	Keying dash

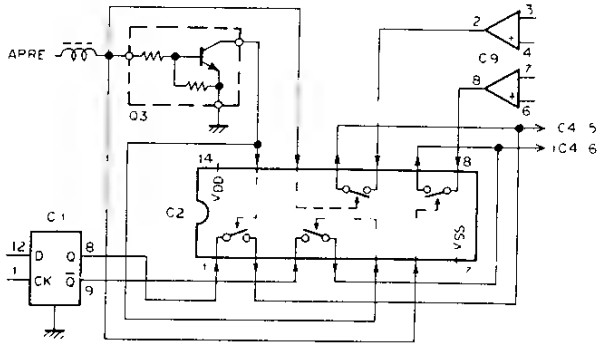
AT UNIT (X53-3240-00)

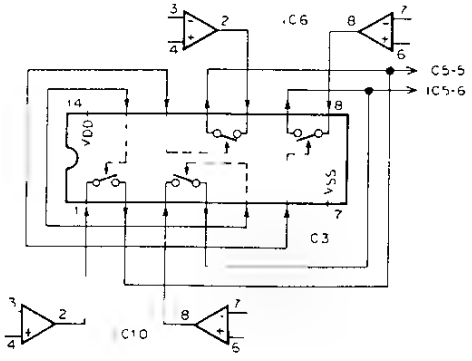
Components	Use/Function	Operation/Condition/Compatibility
IC1	D f p-f.op	D.fferent a phase detection
IC2	Ana.og switch	Control select motor 1
IC3	Analog switch	Contro select motor 2



Function table

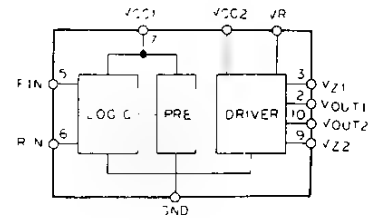
INPUTS		OUTPUTS	
CLOCK	D	Q	Q
↑	L	L	H
⌐	X	Qo	$\overline{Qo}$

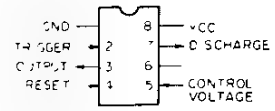


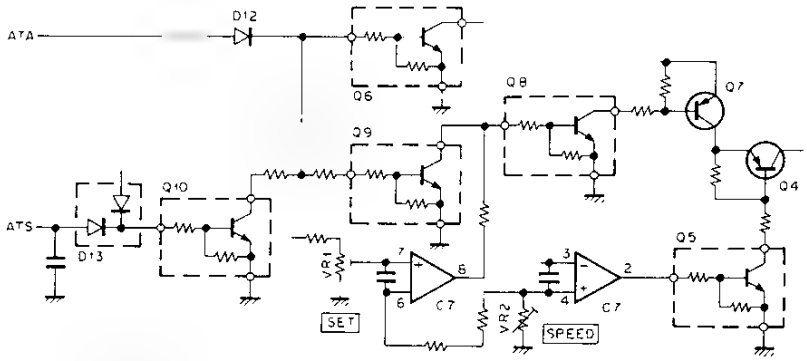


DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
IC4 IC5	Motor drive Motor drive	Motor 1 Motor 2
IC6	Comparator	Differential modulation detection
IC7	Operational amplifier	Motor control
IC8	Timer	Saw wave generated.
Q1,2	Amplifier	Wave shaping
Q3	Switching	Control select
Q4,5	Switching	Motor speed control
Q6	Switching	Saw-wave oscillator on or off
Q7,8	Switching	Motor drive
Q9,10	Switching	Tuning start
D1,2	Detection	Modulation detection (voltage and current)
D3~8	Switching	Clipper
D9	Switching	Voltage drop
D10	Switching	Spike prevention
D11	Switching	Voltage drop
D12	Switching	ATT control
D13	Switching	Tuning start







DSP UNIT (X53-3260-00) : TS-950SD

Components	Use/Function	Operation/Condition/Compatibility
C1,2	HPF	MIC input HPF resistor select
IC3	Signal select	X A/D converter output mute Y A/D converter output select MIC or AF1 Z AF2 output select AF1 or output of D/A converter
C4	Amplifier, filter	1 MIC input amplifier (Gain 6dB) 2 MIC HPF
IC5	Amplifier, filter	1 AF input amplifier (Gain 6dB) 2 MIC HPF
IC6	Limitter	Clipper of the IC7 output

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
.C7	Limiting amp.ifier, f.lter	1 Clipper amp.if er to ±3Vp-p (Ga n 20dB) 2 1st stage of 5th .PF
IC8	F..ter	2nd stage of 5th LPF
.C9	Filter	3rd stage of 5th .PF
IC10	Sample/hold amp! fier	B.ffer
C11	Sample/hold amplifier, amp fier	1 Buffer 2 Amplifier (Gain 6dB)
IC12	A/D con.verter	16 bit A/D converter
IC13,14	A/D converter and gate array .nterface	T.m ng and .og c .nterface of betw.een A/D converter and gate array
.C15	+5V	
IC16	-5V	
IC17	D/A converter	16b.t D/A converter
C18	D/A converter output duty adjust	
IC19	B.ffer	
IC20	LPF	3rd .PF (Ga n -21 6dB)
IC21	Mixer	36 892kHz → 455kHz
IC31	DSP	Modu.ation, AF SLOPE
IC32	Gate array	.nterface (See to c rcu.t descriptio.)
IC33	Reset	Reset pulse when drop DC voltage supp.y
IC34	PLL	2,3,4 . PLL data setting .nput 5 10MHz .nput 7 VCO locked voltage o.tput 11 39 325MHz (VCO) .nput
IC35	+8V	
C36	Tim.ng creat.on	Writ.ng s.gna. creat.on for gate array
Q1	Sample/hold amp.if er	Sw.tching
Q2	Amplifier	Amplif.ed to f.xed .evel from output of the f.ter
Q3	ATT	Sw.tching for ATT On in AM, CW mode
Q4	455kHz o.tput b.ffer	
Q5	m.xer	.nput b.ffer
Q6	mixer	Output b.ffer
Q11	Leve. converter	Level converted to C MOS .evel from TXB (0 ↔ 15)
Q12	10MHz .nput amp.if er	Amplified 10MHz output to PLL IC
Q13	VCO	Osc.llator
Q14	VCO buffer	
Q15	VCO buffer	Output buffer to digital sect.on
Q16	CLK amplifier	Amplif.ed supp.y .evel of gate array from PL. o.tput (39 352MHz)
Q17~19	P.L .PF	
D1	.evel sh.ft	Level shift for sample/hold amp f.er FET)
D2	Limitter	
D3	Reverse current prevention	
D4	VCO vari-cap diode	Frequency adjust

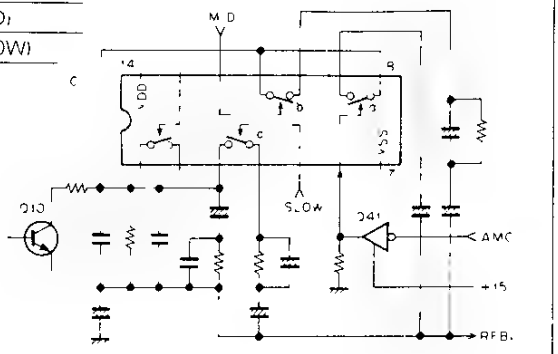
DISPLAY UNIT (X54-3080-00)

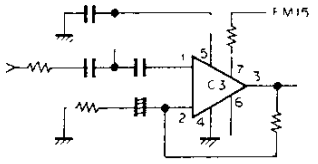
Components	Use/Function	Operation/Condition/Compatibility
IC1	Display SUB CPU	FL tube, LED, sub-tone and BZ m.xer
.C2,3	Display gate array	F. tube control port output.
IC4	Address decoder	Each C chip select
IC5	Function LED .atch	
IC6	Sub-tone output latch	Sub-tone D/A converter o.tput
.C7	.nverter	Logic .nverted
IC8	Sub-tone contro., reset control	
IC9	Output latch	BZ and option VS-2 data o.tput
IC10	Oscillator gate	BZ and 1750Hz tone osc.llator
Q1~137	FL tube starter driver	FL tube starter vo.tage driver from TT. level
D1	F. tube heater bias voltage	Between F and F Approx AC 9 6V Between FG and G Approx DC -28V

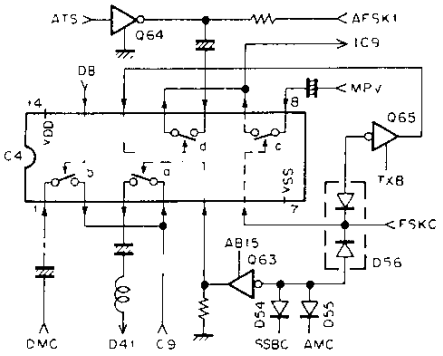
DESCRIPTION OF COMPONENTS

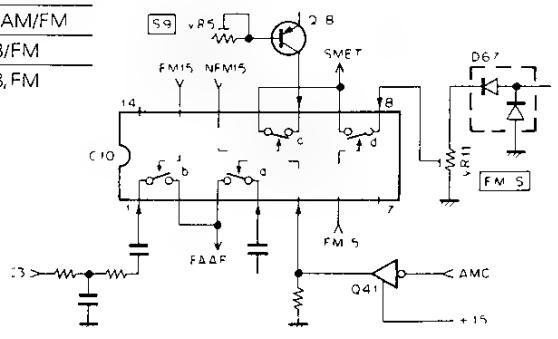
SIGNAL UNIT (X57-3380-00)

Components	Use/Function	Operation/Condition/Compatibility
IC1 (a/4)	AGC select switch	SSB, CW and AM mode select
IC1 (b/4)	AGC select switch	AGC time constant (MID)
IC1 (c/4)	AGC select switch	AGC time constant (SLOW)
IC1 (d/4)		Ununsed
IC2 (a/2)	CAR squelch amplifier	
IC2 (b/2)	FM squelch amplifier	
IC3	FM pre-amplifier	
IC4 (a/4)	DSP-10 select switch	DSP-10 select
IC4 (b/4)	DSP-10 select switch	DSP-10 select
IC4 (c/4)	DSP-10 select switch	SSB, CW (AM) or FSK select
IC4 (d/4)	DSP-10 select switch	On in FSK operates
IC5	Transmitter IF amplifier	455kHz
IC6,7	Receive FM IF amplifier	2 Input. 5 Output
IC8	I/O interface	2~11 I/O 12 SO input. 13 SI input 14 CK input.
IC9	Transmitter amplifier	1 Input. 5 Output
IC10 (a/4)	Select switch	AGC select of AM/SSB, CW
IC10 (b/4)	Select switch	AF output select of AM/FM
IC10 (c/4)	Select switch	Meter select of SSB/FM
IC10 (d/4)	Select switch	Meter select of SSB, FM
Q1,2	Receive IF amplifier	455kHz
Q3	Receive 4th mixer	455kHz → 100kHz.
Q4	IF amplifier	100kHz.

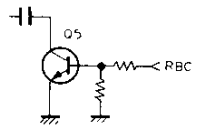
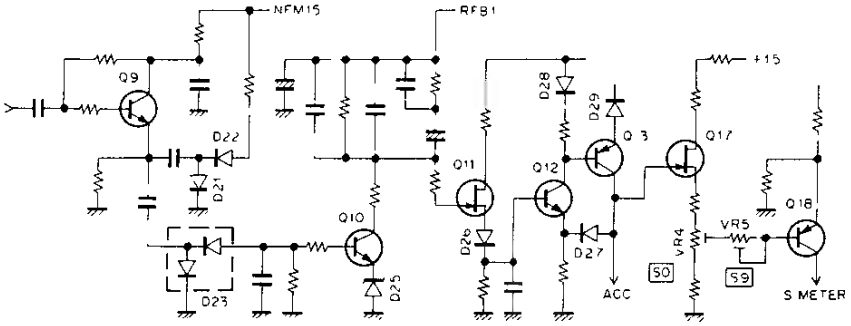
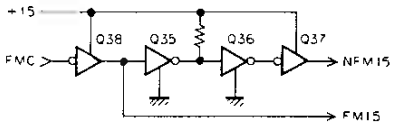
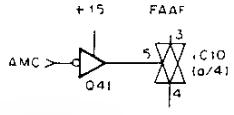
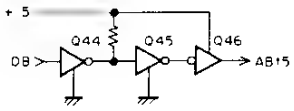




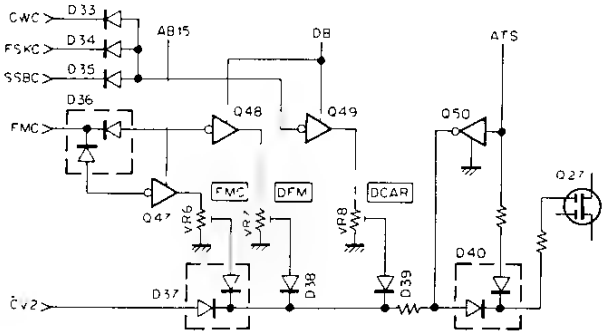
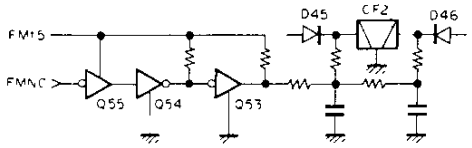
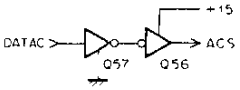




DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
Q5	Switch ng	RBC signal 
Q6	Buffer	AF
Q7	Loca frequency amplif er	355kHz
Q8	CAR buffer	100kHz
Q9	AGC buffer	
Q10~13	AGC amplifier	
Q14	Transmitter CAR mixer	355kHz + 100kHz = 455kHz.
Q15	Transmitter CAR buffer	455kHz
Q16	Transmitter CAR ampl fier	455kHz
Q17,18	S-meter amp ifier	
Q19,20	FM noise amplifier	
Q21	Transmitter IF amp ,fier	455kHz.
Q22	CAR squelch amplifier	
Q25~27	Transmitter IF buffer	455kHz
Q28	Receive FM IF amplifier	455kHz
Q29	FM AF AGC amplifier	
Q30	Processor amplif er	455kHz
Q33	Processor amplifier	455kHz
Q34	FM S-meter amplif er	455kHz
Q35,36	Switch ng	
Q37	Switching	NFM15
Q38	Switching	FM15 
Q39,40	Switching	
Q41	Switching	AM15 
Q42,43	Switching	
Q44,45	Switch ng	
Q46	Switching	AB15 

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
Q47	Switching	FMC
Q48	Switching	DFM
Q49	Switching	DCAR
Q50	Switching	
Q51,52	Switching	
Q53~55	Switching	FM mode 
Q56	Switching	AGS
Q57	Switching	
Q58,59	Switching	D15
Q60	Switching	SSBB
Q61,62	Switching	CV1
Q63~65	Switching	
Q66	Switching	SQ
Q67	Switching	
D1	Switching	Transmitter 455kHz signal
D2,3	Switching	Receive 455kHz signal
D4,5	Switching	CWN filter
D6,7	Switching	CW filter
D8,9	Switching	SSB filter
D10,11	Switching	AM filter
D12,13	Switching	Transmitter 455kHz signal
D14	Switching	Receive 455kHz signal
D15	Tuning	NOTCH frequency.
D16~19	Ring detection	SSB, CW
D20	Voltage regulator	5V
D21,22	Detection	AM
D23	Detection	AGC
D24	Reverse current prevention	AGC + FM15
D25	Voltage shift	3.6V
D26	Temperature compensation	AGC
D27	Reverse current prevention	
D28	Temperature compensation	AGC
D29	Reverse current prevention	AGC
D31	Detection	FM squelch
D32	Reverse current prevention	
D33	Reverse current prevention	CWC
D34	Reverse current prevention	FSKC.
D35	Reverse current prevention	SSBC

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
D36	Reverse current prevent on	
D37	Reverse current prevention	FMC + CV2
D38	Reverse current prevention	DFM
D39	Reverse current prevent.on	DCAR
D40	Reverse current prevention	
D41	Ring modulation	SSB
D42	Detection	CAR squelch
D43	Protect on	Comparator input
D44	Reverse current prevent on	
D45,46	Switch ng	FM 12kHz f lter
D47,48	Switching	FM 6kHz f ter
D49,50	Detection	FM
D51	Rectifier	FM AGC
D52	Reverse c rrent prevention	SSBC
D53	Reverse current prevent on	
D54	Reverse current prevention	SSBC
D55	Reverse current prevent on	AMC
D56	Reverse current prevention	
D57	Voltage regulator	12V
D59	Reverse current prevention	
D60	Switching	Processor
D61~64	Switching	455kHz
D65	L mitter	Compress on meter
D66	Rectifier	Compression meter
D67	Rectifier	FM S-meter
D68,69	Reverse current prevention	
D70	Reverse current prevention	ATS
D71	Voltage regulator	9V

VCO2 (X58-3390-03) : AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q1	VCO0 (PL_0)	64 22MHz
Q2	VCO0 buffer	
D1	VCO0 frequency viable	

VCO (X58-3630-00) : AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q1	VCO1-A (PLL1)	73 06~80 55MHz
Q2	VCO1-B (PL_1)	80 55~87 55MHz
Q3	VCO1-C (PLL1)	87 55~94 55MHz
Q4	VCO1-D (PLL1)	94 55~103.05MHz.
D1	VCO1-A frequency viable	
D2	VCO1 switching	On when VAC s 'L'
D3	VCO1-B frequency viable	
D4	VCO1 switching	On when VBC s ' _'
D5	VCO1-C frequency viable	
D6	VCO1 switching	On when VCC s ' _'
D7	VCO1-D frequency viable	
D8	VCO1 sw tching	On when VDC is ' L"

DESCRIPTION OF COMPONENTS

VCO (X58-3630-01) : PLL UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q1	VCO7-D (PLL7)	61 666~70 055MHz
Q2	VCO7-C (PLL7)	54 555~61 555MHz
Q3	VCO7-B (PLL7)	47 555~54 555MHz
Q4	VCO7-A (PLL7)	40 065~47 555MHz
D1	VCO7-D frequency viable	
D2	VCO7 switching	On when VAC is "L"
D3	VCO7-C frequency viable	
D4	VCO7 switching	On when VBC is "L"
D5	VCO7-B frequency viable	
D6	VCO7 switching	On when VCC is "L"
D7	VCO7-A frequency viable	
D8	VCO7 switching	On when VDC is "L"

AVR UNIT (X43-3070-01) (F/6)

Components	Use/Function	Operation/Condition/Compatibility
Q101,102	Switching	On when over-voltage
D101	Reverse current prevention	
D102	Reference voltage	15V
D103	Protection	On when over-voltage

VOX (X59-1080-01) : AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	VOX level comparator	
IC1 (2/2)	ANTI VOX level comparator	
IC2	NOR circuit	
Q1	Switching	Turn on when 11 pin of IC2 is "H"
D1,2	Reverse current prevention	

FM MIC AMP (X59-3000-03) : AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	Low-pass filter	1,2 Output
IC1 (2/2)	Limiting amplifier	6 Input, 7 Output

NB2 (X59-3350-00) : IF, AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
IC1	One shot multi-vibrator	Synchronized with pulse 5ms or 40ms
Q1,2	Switching	Q1 turned on with 5ms when pulse occurs and Q2 turned off with 40ms

VCO1 (X59-3440-00) PLL, CAR UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q1	VCO	30~110MHz.
Q2	VCO buffer	

LPF (X59-3450-XX) -00 : AF UNIT -01 : PLL, CAR UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q1~3	PLL low-pass filter	Active filter.

DESCRIPTION OF COMPONENTS

MKR (X59-3640-00) : CAR UNIT

Components	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	Div der (1/2)	
IC1 (2/2)	Divider (1/2)	
D1	Switching	
D2	Reverse current prevention	On when CALS s ' _"

SFT (X59-3650-00) : CAR UNIT

Components	Use/Function	Operation/Condition/Compatibility
D1~9	Reverse current prevent on	AFSK div der matr x

CWT (X59-3660-00) : CONTROL UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q201	Switching	Keying s gna
Q202	Switching	Transmitter voltage supp y
Q203~205	Switching	Transmitter stop signa .
Q206~208	Sw tch ng	Keying switch
D201,202	Reverse current prevent on	
D203	Reference voltage	3 6V
D204	Reference voltage	4 7V

MAP (X59-3670-00) : CONTROL UNIT

Components	Use/Function	Operation/Condition/Compatibility
C301	Meter amplif.er	1-2-3 SWR meter 5-6-7 Processor meter.

TRX (X59-3680-00) : CONTROL UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q151	Switch.ng	Receive voltage supply
Q152	Switching	Transmitter vo tage supply
Q153	Switching	Transmitter.
Q154,155	Switching	Rece ve

ALC (X59-3700-00) : CONTROL UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q251	Switching	CKY and DSP
Q252,253	Switching	Stand-by switch contro
Q254	Switching	AT switch
Q255	Sw tching	Parsonal comp.ter interface
D251	Reverse current prevention	
D252	Reference vo tage	12V.

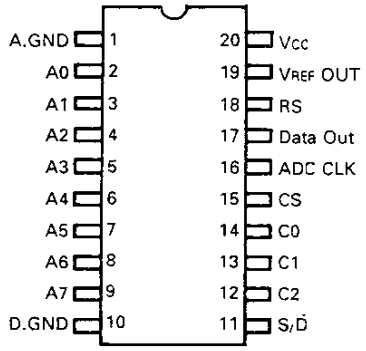
MIC AMP (X59-3710-00) : SWITCH UNIT (A)

Components	Use/Function	Operation/Condition/Compatibility
Q251	MIC amplif.er	Amplified input signal from MIC
Q252	Packet communicat.on switch	Muted to MIC amplifier when using a packet communicat.on.
Q253	Data switch	Muted to MIC amp.ifier when using a data communication.
Q254	M C amp ifier sw tch	Muted to MIC amplifier
Q255	Packet comm.nicat on stand-by sw tch	Transmitter s gnal to supply when using a packet comm.n cat on.
D251	Reverse current prevention	

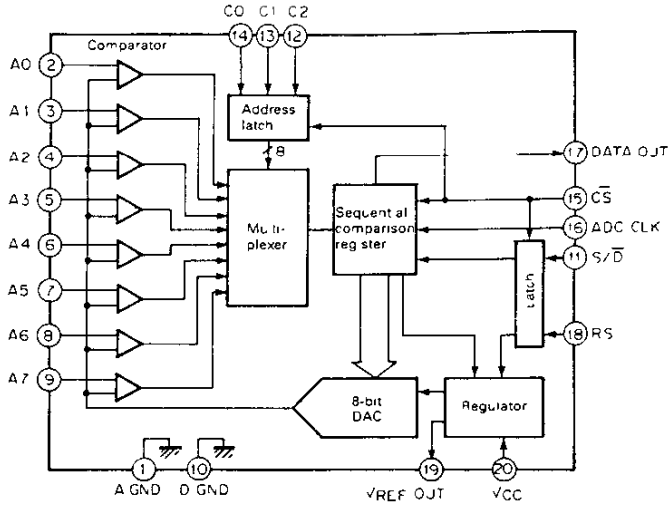
SEMICONDUCTOR DATA

A/D converter : MB4056 (Digital unit IC13)

- **Terminal connection**



- **Block diagram**



- **Terminal function**

Pin No.	Pin name	Name	Function
2~9	A0~A7	Analog input	Eight channel analog input terminals One channel is selected using channel assignment input terminals C0 through C2
11	S/D	Conversion mode select input	Selects the A/D conversion mode When 0, the high and low ranges are converted When 1, either the high or the low range is converted. This signal is latched on the trailing edge of the $\overline{CS}$ signal.
12~14	C2~C0	Channel assignment input	Assigns an analog input channel for analog-to-digital conversion. These signals are latched on the trailing edge of the $\overline{CS}$ signal
15	$\overline{CS}$	Chip select input	Chip select input terminal. When the $\overline{CS}$ signal is set to 1 then 0, analog-to-digital conversion starts and the data output enters the enable state When analog-to-digital conversion is completed or interrupted, the $\overline{CS}$ signal is set to 1
16	ADC CLK	A/D conversion clock input	A/D conversion clock input terminal. The conversion speed is determined by the clock frequency The clock frequency need not be constant
17	Data Out	Data output	This is a terminal (open collector) to output the results of analog-to-digital conversion Output data is synchronized with the ADC CLK signal in the order of start bit, MSB, 2SB through LSB, and stop bit
18	RS	Range select input	Selects the analog input voltage range When 0, the VFS = 1.25V range is selected When 1, the VFS = 5V range is selected This signal is latched on the trailing edge of the $\overline{CS}$ signal
19	VREF OUT	Reference voltage output	This is a terminal (regulator output) to output a reference voltage When the power supply is used at a voltage of 8 to 18V, a regulated 5V voltage is output to the VREF OUT terminal A maximum of 10mA current can be supplied by this terminal.
1	A.Gnd	Analog ground	Ground terminal.
10	D Gnd	Digital ground	
20	Vcc	Power terminal	

- **Range selection**

S/D	RS	1st conversion	2nd conversion
1	0	L	H
1	1	H	L
1	0	L	–
1	1	H	–

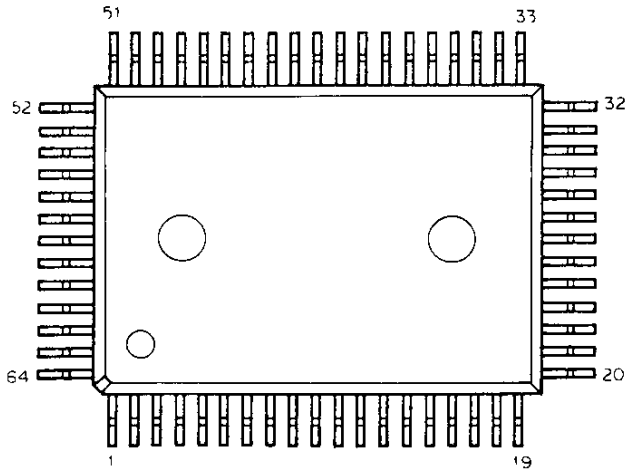
- **Channel selection**

C2	C1	C0	Channel selected
0	0	0	A0
0	0	1	A1
0	1	0	A2
0	1	1	A3
1	0	0	A4
1	0	1	A5
1	1	0	A6
1	1	1	A7

SEMICONDUCTOR DATA

I/O port : CXD1095Q (Digital unit IC6, 8)

- **Terminal connection**



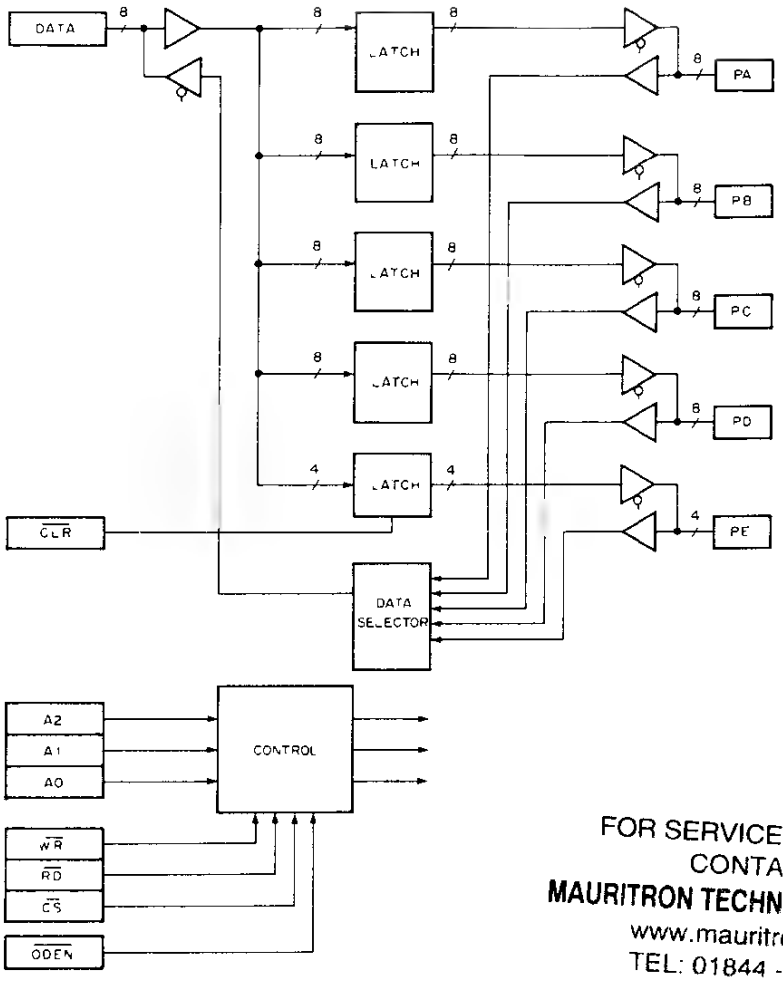
- **Terminal function**

Pin No.	Pin name	I/O	Function
1, 2	NC	–	Not connected
3~9	PB1~PB7	/O	Port B input/output terminals
10	Vss	-	Connected to ground
11~18	PC0~PC7	I/O	Port C input/output terminals
19	NC	–	Not connected
20~24	PD0~PD4	I/O	Port D input/output terminals
25	Vss	–	Connected to ground
26	VDD	–	Connected to +5V
27~29	PD5~PD7	I/O	Port D input/output terminals
30~32	D0~D2	I/O	Eight bit, tristate, b direct ona data bus Data can be sent by connecting these terminals to the data bus of a m crocomputer system Goes act ve when $\overline{CS}$ = 0 and RD = 0 or $\overline{WR}$ = 0
33, 34	NC	–	Not connected
35~39	D3~D7	I/O	Eight bit, tr state, bidirect onal data bus Data can be sent by connect ng these terminals to the data bus of a m crocomputer system. Goes act ve when $\overline{CS}$ = 0 and $\overline{RD}$ = 0 or $\overline{WR}$ = 0
40	$\overline{CLR}$		The register output of port E (4-bit port) is cleared (becomes zero) when $\overline{CLR}$ = 0
41	$\overline{ODEN}$		All ports enter the input state (high- mpedance state) when $\overline{ODEN}$ = 0. No output data register or control reg ster s set
42	Vss	-	Connected to ground
43	$\overline{WR}$	I	Data s wr tten into CXD1095Q when $\overline{WR}$ = 0 Data bus nformation s wr tten on the lead ng edge of the WR s gna. (0 to 1)
44	RD	I	Data is read from CXD1095Q when $\overline{RD}$ = 0
45	CS	I	CXD1095Q is selected when $\overline{CS}$ = 0 and enters the non-selection mode when $\overline{CS}$ = 1 Data nes D7 through D0 enter the high-impedance state
46~48	A0~A2	I	F ve ports and contro registers are selected by addressing
49, 50	PE0, PE1	I/O	Port E nput/output terminals
51	NC	–	Not connected
52, 53	PE2, PE3	I/O	Port E input/output terminals.
54~56	PA0~PA2	I/O	Port A nput/output terminals
57	Vss	–	Connected to ground
58	VDD	–	Connected to +5V
59~63	PA3~PA7	/O	Port A input/output termina s
64	PB0	/O	Port B input/output termina.s

Note The $\overline{CS}$, $\overline{RD}$, $\overline{WR}$, $\overline{ODEN}$, and $\overline{CLR}$ signals are pulled up to Vcc in the IC

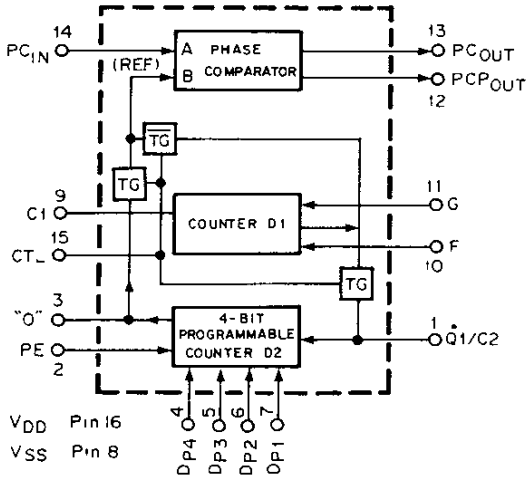
SEMICONDUCTOR DATA

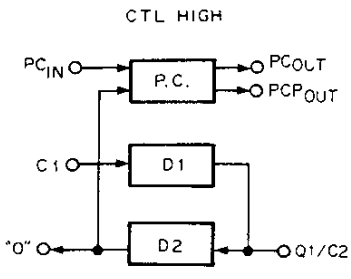
- **Block diagram**

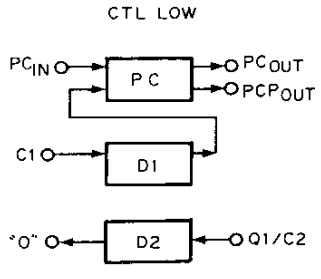


PLL : MC14568BCP (CAR unit IC13)

- **Block diagram**





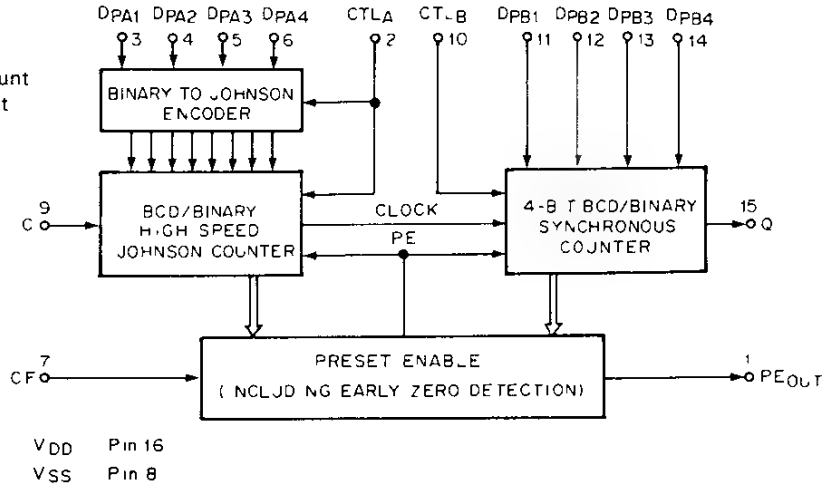


SEMICONDUCTOR DATA

Programmable frequency divider : MC14569BCP (CAR unit IC16)

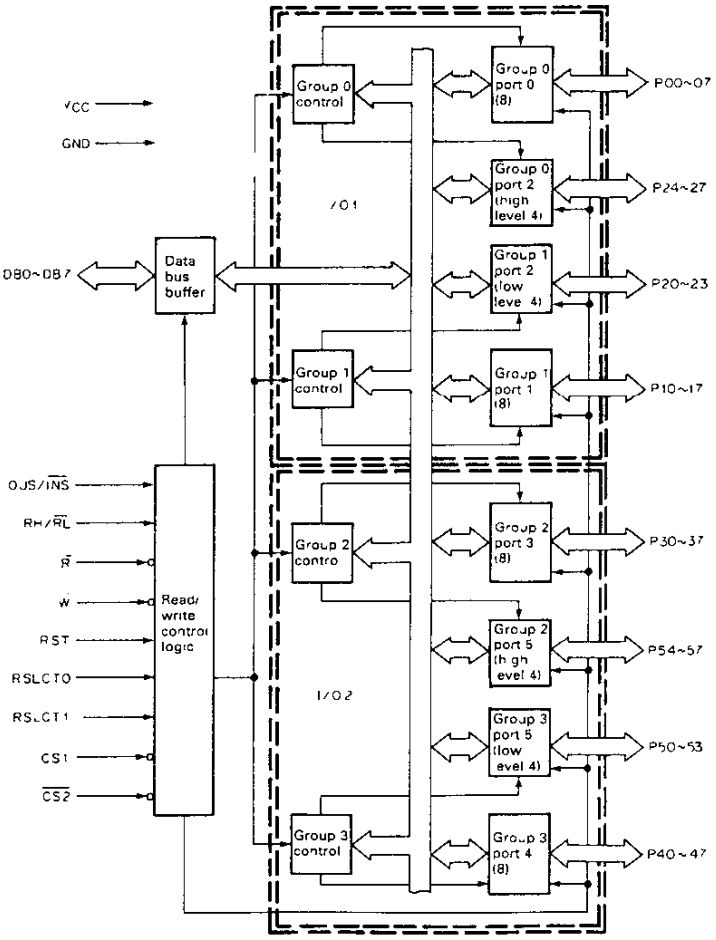
- **Block diagram**

CTL = "0" for Binary Count
CTL = "1" for BCD Count



I/O port : MB89363B (Digital unit IC7)

- **Block diagram**



SEMICONDUCTOR DATA

- **Terminal function**

Pin No.	Pin name	Name	I/O	Function
1~4 77~80	P30~P37	Port 3 all bits	I/O	Eight-bit general purpose input/output port. These terminals are included in group 2. Three operation modes can be selected by setting the control parameter by software.
5	$\overline{W}$	Write	I	The control parameter and port output data item can be written using a low-level signal. The parameter and port data can be distinguished and selected using the $\overline{CS1}$, CS2, RSLCT0, and RSLCT1 signals.
6	RST	Initial setting reset	I	Input terminal. The MB89363B is set to the initial mode using a reset signal, and initial value 9B (hexadecimal) is automatically set for two control parameters. The initial mode indicates that all ports are in the input state of mode 0. All port terminals stay high in the initial mode. The active signal level is selected using an RH/$\overline{RL}$ signal. RH/$\overline{RL}$ = 0: $\overline{RST}$ (active low) RH/$\overline{RL}$ = 1: RST (active high)
9	RH/$\overline{RL}$	Reset active level selection	I	The RST terminal is set to active high or active low. RH/$\overline{RL}$ = 0: $\overline{RST}$ (active low) RH/$\overline{RL}$ = 1: RST (active high) The RH/$\overline{RL}$ terminal is fixed at either Vcc or GND at all times.
11	OLS/$\overline{INS}$	Port 0 and 3 read value selection	I	This terminal indicates the output state of ports 0 and 3. It also selects whether the external terminal value of ports 0 and 3 is read directly or whether the output latch value of ports 0 and 3 is read directly when reading the value of ports 0 and 3. OLS/$\overline{INS}$ = 0: The output latch value of ports 0 and 3 is read. OLS/$\overline{INS}$ = 1: The external terminal value of ports 0 and 3 is read.
12~19	DB0~DB7	Bidirectional data bus	I/O	Eight-bit, bidirectional data bus. These terminals are used for data communication with the MPU. The bus signal making and breaking and data direction are controlled using the $\overline{CS1}$, $\overline{CS2}$, R and $\overline{W}$ signals.
20~23 25~28	P00~P07	Port 0 all bits	I/O	Eight-bit, general purpose input/output port. These terminals are included in group 0. Three operation modes can be selected by setting the control parameter by software.
29 75	$\overline{CS1}$ CS2	Device selection	I	When a low-level signal is input to this terminal, signals DB0 through DB7 are released and data communication with the MPU takes place. At that time, the control parameter is written, and data is written into or read from each port. $\overline{CS1}$ = 0: /O1 $\overline{CS2}$ = 0: I/O2 Simultaneous selection of $\overline{CS1}$ = 0 and CS2 = 0 is prohibited.
30, 74	GND	Ground terminal		0V
31 32	RSLCT0 RSLCT1	Access selection	I	When data is sent to the MPU, the parameter and port are distinguished and selected using the $\overline{CS1}$, $\overline{CS2}$, RSLCT0, and RSLCT1 signals.
34~40 43	P20~P27	Port 2 all bits	I/O	These terminals are used as a general-purpose input/output port, handshaking control terminals, and status data bit input/output terminals in accordance with the operation functions and modes of groups 0 and 1.
44~51	P10~P17	Port 1 all bits	I/O	Eight bit, general-purpose input/output port. These terminals are included in group 1. Two operation modes can be selected by setting the control parameter by software.
53	Vcc			+5V power
54~61	P40~P47	Port 4 all bits	I/O	Eight-bit, general-purpose input/output port. These terminals are included in group 3. Two operation modes can be selected by setting the control parameter by software.
62 65~71	P50~P57	Port 5 all bits	I/O	These terminals are used as a general-purpose input/output port, handshaking control terminals, and status data bit input/output terminals.
76	R	Read	I	Data from each port is read using a low-level signal. The port type is selected using the $\overline{CS1}$, $\overline{CS2}$, RSLCT0, and RSLCT1 signals.
7,8,10,24 33,41,42 52,63,64 72,73	NC	–	–	Connection to the NC terminal is inhibited.

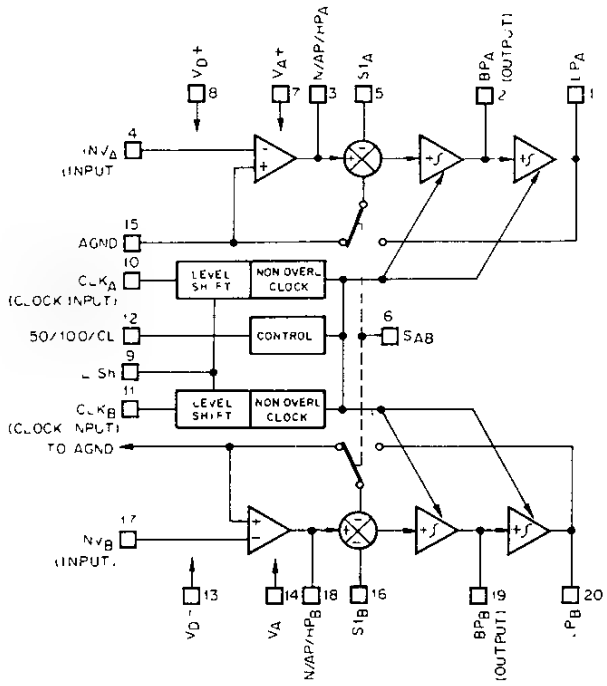
SEMICONDUCTOR DATA

Switched capacitor filter : MF10CCWM (AF unit IC2)

- **Features**

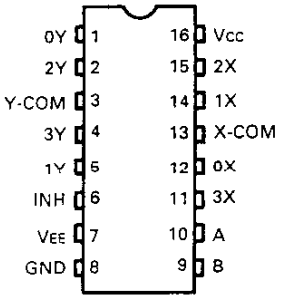
· The cut-off frequency stability varies depending on the external clock.
· The cut-off and center frequencies of a filter can be set and altered using the external clock frequency.
· 20-pin DIP package.
· SO package is provided for surface installation.
· Clock and center frequencies have a high precision ratio (fCLK/fO). (±0.6% : MF10AC, ±1.5% : MF10C)
· Three independent low-pass, bandpass, and high-pass (or notch or all-pass) outputs.
The product of center frequency fO and Q (fO x Q) is 200kHz.
· Input frequency is 20kHz (representative value is 30kHz).

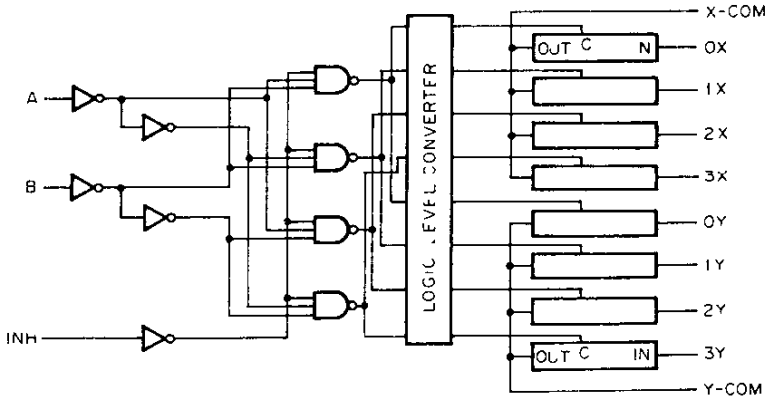
- **Block diagram**



HPF : MC74HC4052F (DSP unit IC1, 2)

- **Terminal connection**
- **Logic circuit diagram**





- **Truth table**

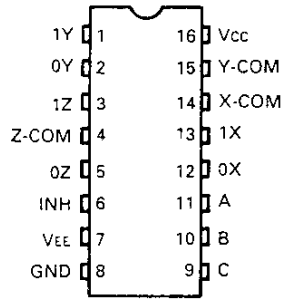
CONTROL INPUTS			"ON" CHANNEL
INHIBIT	B	A	
L	L	L	0X,0Y
L	L	H	1X,1Y
L	H	L	2X,2Y
L	H	H	3X,3Y
L	L	L	-
L	L	H	-
L	H	L	-
L	H	H	-
H	X	X	NONE

X Do not care

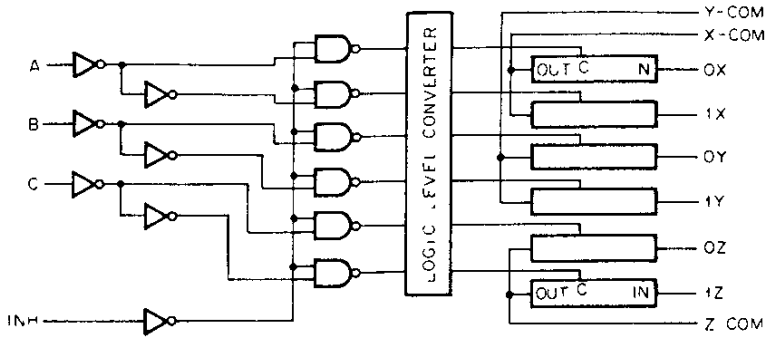
SEMICONDUCTOR DATA

Analog switch : MC74HC4053F (DSP unit IC3)
D/A output duty variable : MC74HC4053F (DSP unit IC18)
Mixer : MC74HC4053F (DSP unit IC21)

- **Terminal connection**



- **Logic circuit diagram**



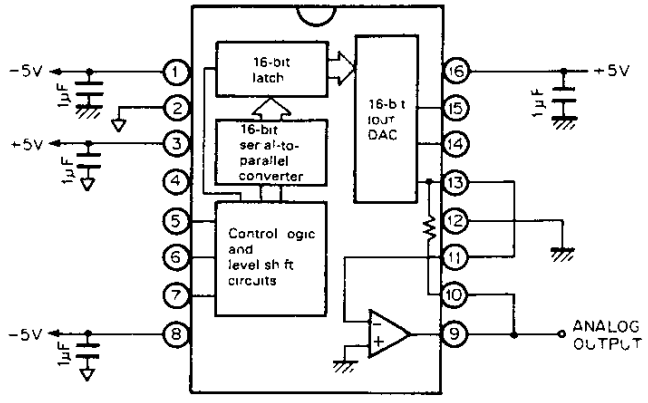
- **Truth table**

CONTROL INPUTS				'ON' CHANNEL
INHIBIT	C	B	A	
L	L	L	L	0X,0Y,0Z
L	L	L	H	1X,0Y,0Z
L	L	H	L	0X,1Y,0Z
L	L	H	H	1X,1Y,0Z
L	H	L	L	0X,0Y,1Z
L	H	L	H	1X,0Y,1Z
L	H	H	L	0X,1Y,1Z
L	H	H	H	1X,1Y,1Z
H	X	X	X	NONE

X Do not care

D/A converter : PCM56P (DSP unit IC17)

- **Terminal connection**



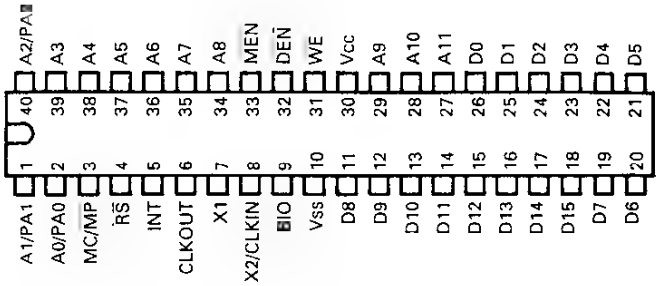
- **Terminal function**

Pin No.	Pin name	Function
1	-Vs	Analog negative power supply
2	LOG COM	Logic common
3	+VL	Logic positive power supply
4	NC	Not connected
5	CLK	Clock input
6	LE	Latch enable input
7	DATA	Serial data input
8	-VL	Logic negative power supply
9	VOUT	Voltage output
10	RF	Feedback resistor
11	SJ	Summing junction
12	ANA COM	Analog common
13	IOUT	Current output
14	MSB ADJ	MSB adjustment terminal
15	TRIM	MSB trim potentiometer terminal
16	+Vs	Analog positive power supply

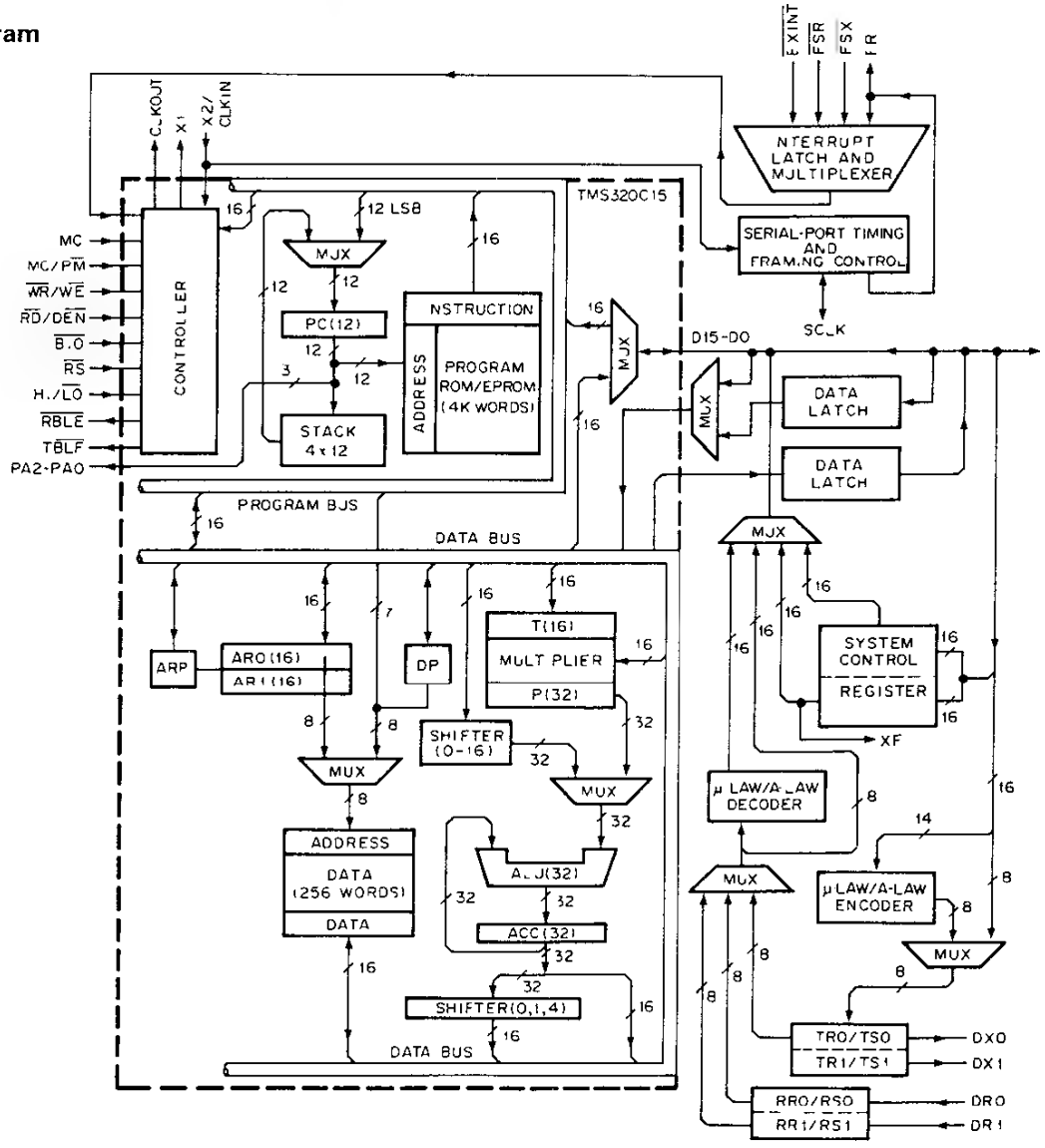
SEMICONDUCTOR DATA

DSP : TMS320E15JJBC1 (DSP unit IC31)

- **Terminal connection**



- **Block diagram**



ACC = ACCUMULATOR
ARP = AUXILIARY REGISTER POINTER
AR0 = AUXILIARY REGISTER 0
AR1 = AUXILIARY REGISTER 1
DP = DATA PAGE POINTER
PC = PROGRAM COUNTER
P = P REGISTER
T = T REGISTER
TR = TRANSMIT REGISTER
RR = RECEIVE REGISTER

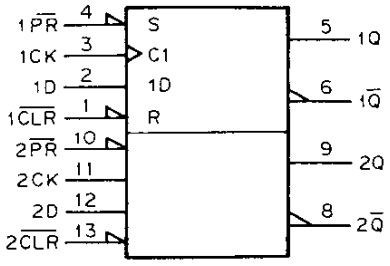
SEMICONDUCTOR DATA

- **Terminal function**

Pin name	Pin No.	I/O	Function
			Power supply
Vcc	30		Supply voltage (+5V NOM)
Vss	10	–	Ground
			Clock
X2/CLKIN	8	I	Internal clock crystal input pin (X2). This terminal is also used as an external clock input pin (CLKIN)
X1	7	O	Internal clock crystal output pin
CLKOUT	6	O	Clock output signal. The CLKOUT signal frequency is 1/4 of the external clock input or internal clock crystal frequency. The duty ratio is 50%.
			Control
$\overline{WE}$	31	O	TMS32010 indicates that data on the data bus is valid during active low. Goes active in the first cycle only of an OUT command and the second cycle of a TBLW command. When the WE signal is active, the $\overline{MEN}$ and $\overline{DEN}$ signals are high at all times.
$\overline{DEN}$	32	O	TMS32010 indicates that data is received from the data bus during active low. Goes active in the first cycle only of an IN command. The $\overline{MEN}$ and $\overline{WE}$ signals are high at all times.
$\overline{MEN}$	33	O	Goes active except when the $\overline{WE}$ and $\overline{DEN}$ signals are active during active low. This is a control signal used to fetch commands from on-chip and off-chip program memory.
			Interrupt
$\overline{RS}$	4	I	Reset. When the $\overline{RS}$ pin is made low for five clock cycles (minimum) during active low, the $\overline{DEN}$, $\overline{WE}$, and $\overline{MEN}$ signals go high and data lines D15 through D0 take on a high impedance. The PC and address lines A11 through A0 are simultaneously cleared on clock cycle after the trailing edge of the $\overline{RS}$ signal, and all address lines go low. The interrupt mask and interrupt flag register are cleared, but the overflow mode register, data pointer, and auxiliary register pointer are not altered. The device is in reset mode until this signal goes high.
$\overline{INT}$	5	I	Interrupt. An interrupt signal is generated on the trailing edge of the $\overline{INT}$ signal. This edge is used to latch the interrupt flag register (INTF) until a device interrupt occurs. The interrupt is also possible when low.
$\overline{BIO}$	9	I	Input/output branch control. This branches to the address designated using commands when the $\overline{BIO}$ signal is active (low) during BIOZ command execution.
			Program memory control
MC/$\overline{MP}$	3	I	Microcomputer/microprocessor mode. When MC/$\overline{MP}$ = 1, the microcomputer mode is in effect and there is a 1524-word on-chip program memory. Address 1523 through 1535 are used for testing. A 2560 word program memory can be installed externally in this mode. When MC/$\overline{MP}$ = 0, microprocessor mode is in effect and all program memory is installed externally.
			Bidirectional data bus
D15~D8	18~11	I/O	Data lines D15 (MSB) through D0 (LSB) always take on a high impedance except when the $\overline{WE}$ signal is
D7~D0	19~26	I/O	active (low).
			Program memory address bus and port address bus
A11~A9	27~29	O	Program memory address lines A11 (MSB) through A0 (LSB) and port address lines PA2 (MSB) through
A8~A3	34~39	O	PA0 (LSB). Lines A11 through A0 do not take on a high impedance. Lines A2 through A0 indicate port
A2/PA2	40	O	address PA2 through PA0 during IN/OUT command execution.
A1/PA1	1	O	
A0/PA0	2	O	

A/D gate array interface : TC74HC74AF (DSP unit IC14)

- **Logic circuit diagram**



- **Truth table**

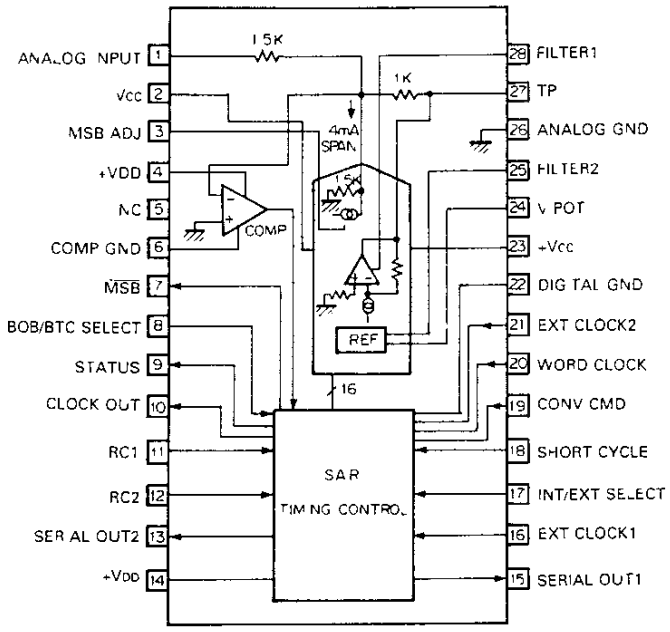
INPUTS				OUTPUTS		FUNCTION
$\overline{CLR}$	PR	D	CK	Q	$\overline{Q}$	
L	H	X	X	L	H	CLEAR
H	L	X	X	H	L	PRESET
L	L	X	X	H	H	–
H	H	L	↑	L	H	–
H	H	H	↑	H	L	–
H	H	X	↓	Qn	$\overline{Qn}$	NO CHANGE

X : Do not care

SEMICONDUCTOR DATA

A/D converter : PCM78AP (DSP unit IC12)

- **Block diagram**



- **Terminal function**

Pin No.	Pin name	I/O	Function
1	ANALOG INPUT	I	A/D converter analog input Input impedance 1.5kΩ (TYP)
2	–Vcc	–	Analog –Vcc.
3	MSB ADJ		MSB adjustment (MSB DNL compensation) input terminal
4	+VDD	–	Comparator +VDD
5	NC	–	
6	COMP GND	–	Comparator ground Usually connected to digital common
7	$\overline{\text{MSB}}$	O	$\overline{\text{MSB}}$ output terminal
8	BOB/BTC SELECT		Output digital code selection terminal "L" BOB, "H" BTC
9	STATUS	O	Status signal output terminal
10	CLOCK OUT	O	Main clock output terminal for SAR operation
11	RC1	–	Internal clock oscillation frequency setting terminal Pulled up to +VDD by 10kΩ when an external clock is used.
12	RC2	–	Internal clock oscillation frequency setting terminal Pulled up to +VDD by 10kΩ when an external clock is used.
13	SERIAL OUT2	O	Serial data output synchronized with EXT CLOCK2 signal
14	+VDD	–	Digital +VDD
15	SERIAL OUT1	O	Serial data output synchronized with internal clock or EXT CLOCK1
16	EXT CLOCK1	I	External clock (EXT CLOCK1) input Opened or pulled up when not used.
17	INT/EXT SELECT	I	Internal/external clock selection terminal "L" INT, "H" EXT
18	SHORT CYCLE	I	Short cycle timing input terminal
19	CONV CMD	I	Conversion command signal input terminal. Set low when not used
20	WORD CLOCK	I	WORD CLOCK input terminal Opened or pulled up when not used
21	EXT CLOCK2	I	External clock (EXT CLOCK2) input terminal Opened or pulled up when not used
22	DIGITAL GND	–	Digital ground
23	+Vcc	–	Analog +Vcc.
24	V POT	O	MSB adjustment reference voltage output terminal.
25	FILTER2	–	Internal reference filter A 3.3μF capacitor is connected to –Vcc.
26	ANALOG GND	–	Analog ground A 2.2μF capacitor is connected to ANA GND
27	TP	–	Test point for operation check.
28	FILTER1	–	Internal reference filter A 3.3μF capacitor is connected to ANA GND

PARTS LIST

PRECAUTIONS ABOUT PARTS LIST

● On general purpose chip parts

From a part number, the resistance value and capacity value are omitted, and "XXX" is used instead (Ex. RD41DB2BXXX.)
In this case, from the circuit diagram, the reference number and resistance value and capacitance value are read, and they are changed into a part number making use of the following table.

In addition, it should be noted that of those parts represented by serial reference numbers, some numbers may be unused.
The unused numbers are listed on the circuit diagram.

● On resistance RD14BB

Of resistance RD14BB, any part number of less than 1/4W is omitted from the parts list.

● On symbols occurring on parts list

* indicates new parts
! indicates safty critical components

E Europe **K** USA **P** Canada **W** Europe
U PX (Far East, Hawaii) **T** England **M** Other Areas
UE AAFES (Europe) **X** Australia **L** Northern Europe

Resistor value	Capacitor value
22Ω → 2 2 0 Multiplier 2nd number 1st number	22pF → 2 2 0 Multiplier 2nd number 1st number
0.5Ω = 0R5	0.5pF = 0R5
1Ω = 010	1pF = 010
10Ω = 100	10pF = 100
100Ω = 101	100pF = 101
1000Ω = 1KΩ = 102	1000pF = 0.001μF = 102
10KΩ = 103	0.01μF = 103
100KΩ = 104	
1000KΩ = 1MΩ = 105	

Letter "R" is used for the decimal point. In this case, all become significant figures.

PARTS LIST

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Ref. No 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
			TS-950S/SD			
1	1A	*	A01-1073-1.	METALLIC CABINET(TOP)	KP	S
1	1A	*	A01-1081-11	METALLIC CABINET(TOP)	MWW2X	S
1	1A	*	A01-1082-11	METALLIC CABINET(TOP)	KP	D
1	1A	*	A01-1083-11	METALLIC CABINET(TOP)	MWW2X	D
2	3A	*	A01-1074-1.	METALLIC CABINET(BOTTOM)	KMWW2	
2	3A	*	A01-1074-11	METALLIC CABINET(BOTTOM)	X	
2	3A	*	A01-1093-01	METALLIC CABINET(BOTTOM)	P	
3	2D	*	A20-7024-02	PANEL		S
3	2D	*	A20-7026-02	PANEL		D
4	2D	*	A20-7025-02	PANEL ASSY		S
4	2D	*	A20-7027-02	PANEL ASSY		D
5	2G	*	A23-1515-02	REAR PANEL		
6	1K	*	A40-0624-03	BOTTOM PLATE		S
8	1K	*	B04-0412-04	MESH PLATE		
-		*	B04-0413-03	MESH PLATE	P	
10	2D	*	B10-1119-03	FRONT GLASS		
11	2C	*	B11-0466-04	FILTER		
-		*	B40-3951-04	MODEL NAME PLATE	KP	
-		*	B40-3966-04	MODEL NAME PLATE	M	
-		*	B40-3967-04	MODEL NAME PLATE	WW2	
-		*	B40-7608-04	MODEL NAME PLATE	X	
-			B41-0338-04	CAUTION LABEL(LIGHTING MARKING	KP	
-			B41-0525-04	CAUTION LABEL(FUSE REPLACEMENT	KP	
-			B42-3343-04	LABEL(S/NO)		
-		*	B42-3365-04	LABEL(PRE SET)		
-		*	B42-3371-04	LABEL ACSY(REAR PANEL VIEW)		
-		*	B42-3374-04	LABEL(AC 120/220V)	M	
-		*	B42-3375-04	LABEL(AC 220/220V)	WW2	
-		*	B42-3376-04	LABEL(AC 120/240V)	X	
		*	B42-3395-04	LABEL	K	D
18	2C	*	B43-1098-04	BADGE		
-			B44-2163-04	LABEL(JPC CORD)		
-		*	B46-0425-00	WARRANTY CARD	K	
-			B46-0419-00	WARRANTY CARD	WW2	
-			B46-0422-00	WARRANTY CARD	P	
-		*	B50-8298-10	INSTRUCTION MANUAL		
-		*	B50-8351-00	INSTRUCTION MANUAL(COMMAND EXP		
20	2K		E04-0167-05	RF COAXIAL CABLE RECEPTACLE		
-			E07-0751-05	7P DIN PLUG ACSY		
-			E07-1351-05	13P ROUND PLUG ACSY		
22	3K		E13-0101-05	PIN JACK		
-			E29-0114-05	CAP	WW2X	
-			E30-0974-05	AC POWER CORD	KM	
			E30-2125-05	AC POWER CORD	P	
-		*	E30-2153-15	AC POWER CORD	WW2	
-		*	E30-2159-15	AC POWER CORD	X	
-		*	E30-2176-05	CORD WITH PINPLUG		
-			E31-2048-05	CONNECTING WIRE(AT)		
		*	E31-3111-15	CONNECTING WIRE(AT)		
-			E31-3221-25	CONNECTING WIRE(MIF)		
		*	E31-6067-05	CONNECTING WIRE(SIG-CONT)14P		
-		*	E31-6068-05	CONNECTING WIRE(SIG-AF) 14P		

E Scandinavia & Europe K USA P Canada W.Europe
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-		*	E31-6069-05	CONNECTING WIRE(SIG-DIG,AF-DIG		
-		*	E31-6070-05	CONNECTING WIRE(DIS-SWA) 18P		
-		*	E31-6071-05	CONNECTING WIRE(DIG-DIG) 10P		
-		*	E31-6072-05	CONNECTING WIRE(PLL-DIG) 24P		
		*	E31-6073-05	CONNECTING WIRE(CONT-DIG,16P		
-		*	E31-6074-05	CONNECTING WIRE(SWA-DIG) 20P		
35	2I	*	F01-0968-13	HEAT SINK		
36	1I		F05-3121-05	FUSE(SEMKO 3.15A)	WW2X	
36	1I		F05-3523-05	FUSE(3.5A)	M	
-			F05-6021-05	FUSE ACSY(6A)	M	
36	1I		F05-6027-05	FUSE(UL 6A)	KP	
37	1A	*	F07-0886-04	COVER(FOR TOP CABINET)		
38	1G	*	F07-0887-04	COVER(REAR PANEL FAN SIDE)		
39	2G,2H	*	F09-0423-05	FAN		
40	1K	*	F11-1139 23	SHIELDING COVER(FINAL)		
41	3G	*	F11-1153-03	SHIELDING COVER(RF)		
42	1E	*	F20-1022-03	INSULATING BOARD(SW)		
-		*	F20-1041-04	INSULATING BOARD(RF SHIELD)		
-		*	F20-1036-04	INSULATING BOARD(AVR)		
-		*	F20-1043-04	INSULATING BOARD(CHASSIS)		
-			G02-0505-05	LEAF SPRING		
48	1I		G02-0574-04	FLAT SPRING		
49	1I		G02-0576-04	FLAT SPRING		
50	1A		G10-0656-04	NON-WOVEN FABRIC(SP)		
-			G10-0662-04	NON-WOVEN FABRIC		
52	1E	*	G10-0687-14	NON-WOVEN FABRIC(FILTER)		
-			G11-0609-04	CUSHION(MIC)		
-			G13-0855-04	FORMED PLATE(MIC)		
53	2D	*	G13-0917-04	CUSHION(KNOB)		
54	2D	*	G13-0918-04	CUSHION(KNOB)		
55	1A	*	G13-0919-04	CUSHION(SP)		
56	3H	*	G13-0927-04	CUSHION(ELECTRO CAP)		
-		*	G13-0943-14	CUSHION(TRANSFORMER)		
58	2H	*	G16-0530-04	SHEET(SP)		
-		*	H01-8263-04	ITEM CARTON BOX		S
-		*	H01-9604-04	ITEM CARTON BOX		S
-		*	H03-2783-04	OUTER PACKING CASE		S
-		*	H03-2784-04	OUTER PACKING CASE		S
-		*	H10-2666-01	POLYSTYRENE FOAMED FIXTURE		
-		*	H10-2667-01	POLYSTYRENE FOAMED FIXTURE		
-		*	H12-1419-04	PACKING FIXTURE		
-		*	H20-1434-03	PROTECTION COVER		
-			H25-0117-04	PROTECTION BAG(ACSY)		
-			H25-0105-04	PROTECTION BAG(MIC)		
60	3B		J02-0049-14	FOOT(REAR)		
61	3A		J02-0423-04	FOOT(FRONT)		
62	3A		J02-0424-04	FOOT(FRONT)		
63	1A,3A		J02-0426-05	FOOT(SIDE)		
64	2H		J19-1382-05	LEAD HOLDER		
65	2F		J21-2664-14	MOUNTING HARDWARE(CONT B/3)		
66	2J	*	J21-4272-03	MOUNTING HARDWARE(HEAT SINK)		
67	2H	*	J21-4273-04	MOUNTING HARDWARE(FAN)		
68	2H	*	J21-4274-04	MOUNTING HARDWARE.SP)		
69	2H	*	J21-4275-04	MOUNTING HARDWARE(ELECTRO CAP)		

E Scandinavia & Europe K USA P Canada W Europe
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70	1I	*	J21-4276-04	MOUNTING HARDWARE(AVR)		
71	2K	*	J21-4277-04	MOUNTING HARDWARE(REAR PANEL)		
72	3J	*	J21-4278-04	MOUNTING HARDWARE(AT		
73	1D		J31-0141-04	COLLAR(MIC)		
74	2I	*	J32-0909-04	STUD(AVR		
75	2I	*	J32-0910-04	STUD(AVR)		
-			J42-0083-05	BUSHING(AC)	KM	
-			J42-0085-05	BUSHING(AC)	ww2X	
77	2G		J50-0401-05	HINGE		
78	1A		J59-0001-05	GROMMET		
79	1A		J59-0002-05	GROMMET		
-			J61-0033-05	WIRE BAND,SUB TRANSFORMER)		
-			J61-0039-05	WIRE BAND(PLL)		
-			J61-0307-05	WIRE BAND		
80	1B		K01-0407-05	HANDLE		
81	2C	*	K21-0789-12	KNOB(MAIN TUNING)		
82	2C	*	K23-0793-04	KNOB(NOTCH)		
83	2C	*	K23-0794-04	KNOB(ATT,AGC)		
84	2C		K29-0761-04	KNOB RING		
85	2I	*	K29-3172-04	KNOB(M.CH)		
86	2I	*	K29-3173-04	KNOB(METER)		
87	2I	*	K29-3174-03	KNOB(0)		
88	2I	*	K29-3175-03	KNOB(1)		
89	2I	*	K29-3176-03	KNOB(2)		
90	2I	*	K29-3177-03	KNOB(3)		
91	2I	*	K29-3178-03	KNOB(4)		
92	2I	*	K29-3179-03	KNOB(5)		
93	2I	*	K29-3180-03	KNOB(6)		
94	2I	*	K29-3181-03	KNOB(7)		
95	2I	*	K29-3182-03	KNOB(8)		
96	2I	*	K29-3183-03	KNOB(9)		
97	2I	*	K29-3184-03	KNOB(CLR)		
98	2I	*	K29-3185-03	KNOB(ENT)		
99	2I	*	K29-3186-03	KNOB(TF-W)		
100	2I	*	K29-3187-03	KNOB(SUB)		
101	2I	*	K29-3188-03	KNOB(STEP)		
102	2I	*	K29-3189-03	KNOB(TF-SET)		
103	2I	*	K29-3190-03	KNOB(TONE)		
104	2I	*	K29-3191-03	KNOB(VOICE)		
105	2I	*	K29-3192-03	KNOB(8.83)		
106	2I	*	K29-3193-03	KNOB(455)		
107	2I	*	K29-3194-03	KNOB(LSB)		
108	2I	*	K29-3195-03	KNOB(USB)		
109	2I	*	K29-3196-03	KNOB(CW)		
110	2I	*	K29-3197-03	KNOB(FSK)		
111	2I	*	K29-3198-03	KNOB(AM)		
112	2I	*	K29-3199-03	KNOB(FM)		
113	2I	*	K29-3200-03	KNOB(ROUND MARK)		
114	2I	*	K29-4501-03	KNOB(F.LOCK)		
115	2I	*	K29-4502-03	KNOB(A=B)		
116	2I	*	K29-4503-03	KNOB(RX-SUB)		
117	2I	*	K29-4504-03	KNOB(DATA)		
118	2I	*	K29-4505-04	KNOB(MIN)		
119	2I	*	K29-4506-04	KNOB(M-VFO)		

E. Scandinavia & Europe K USA P Canada W-Europe
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120	2I	*	K29-4507-04	KNOB(SCAN)		
121	2I	*	K29-4508-04	KNOB(DOWN)		
122	2C	*	K29-4509-04	KNOB(UP)		
123	2D	*	K29-4510-04	KNOB(VOX)		
124	1D	*	K29-4511-04	KNOB(POWER)		
125	1D	*	K29-4512-04	KNOB(VOX,FULL)		
126	1D	*	K29-4513-04	KNOB(PROC)		
127	2C	*	K29-4514-04	KNOB(SQL)		
128	2C	*	K29-4515-04	KNOB(MAIN,MIC)		
129	2C	*	K29-4516-04	KNOB(SUB,PWR)		
130	1D,1E	*	K29-4518-04	KNOB(SEND,RIT)		
133	2I	*	L01-8421-15	POWER TRANSFORMER(MAIN 120V)	KP	
133	2I	*	L01-8426-15	POWER TRANSFORMER(MAIN 120-100	MWW2X	
134	3H	*	L01-8431-05	POWER TRANSFORMER(SUB 120V)	KP	
134	3H	*	L01-8436-05	POWER TRANSFORMER(SUB 120-100	MWW2X	
-	3H		L79-0847-05	FILTER ASSY(YK-88C-1)		D
A	2K		N09-0682-04	HEX BOLT		
		*	N09-2051-05	SCREW	X	
136	2K		N14-0115-05	NUT		
137	2K		N14-0509-05	NUT		
138	2K		N15-1040-46	FLAT WASHER		
139	2C		N19-0637-04	FLAT WASHER(PANEL)		
B	1E,2F		N32-2606-46	FLAT HEAD MACHINE SCREW		
C	1D,1H		N32-3006-46	FLAT HEAD MACHINE SCREW		
-			N33-3006-41	OVAL HEAD MACHINE SCREW	P	
D	1B,3B		N33-4008-41	OVAL HEAD MACHINE SCREW		
E	1E		N35-2604-46	BINDING HEAD MACHINE SCREW		
-			N35-2606-46	BINDING HEAD MACHINE SCREW	MWW2X	
F	1I	*	N35-2608-46	BINDING HEAD MACHINE SCREW		
G	1I		N35-3006-46	BINDING HEAD MACHINE SCREW		
H	2I		N35-3010-46	BINDING HEAD MACHINE SCREW		
I	1I	*	N35-4018-46	BINDING HEAD MACHINE SCREW		
J	3F		N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
K	1G,1K		N87-3006-46	BRAZIER HEAD TAPTITE SCREW		
L	3K		N87-3010-46	BRAZIER HEAD TAPTITE SCREW		
M	2I		N87-3014-46	BRAZIER HEAD TAPTITE SCREW		
N	3A		N87-4010-46	BRAZIER HEAD TAPTITE SCREW		
O	2G		N88-3006-46	FLAT HEAD TAPTITE SCREW		
P	2K		N89-3006-45	BINDING HEAD TAPTITE SCREW		
Q	2G		N89-3008-45	BINDING HEAD TAPTITE SCREW		
R	3H,2I	*	N90-4004-46	TP HEAD MACHINE SCREW(TRANS)		
S	2C		N90-3008-46	TP HEAD MACHINE SCREW		
-		*	S31-2418-05	SLIDE SWITCH	MWW2X	
141	1D	*	S40-2460-05	PUSH SWITCH		
-			S50-1406-05	SENSITIVE SWITCH(MIC)		
142	1H		T07-0221-05	LOUDSPEAKER(FULLRANGE)		
-			T91-0352-15	MICROPHONE		
-		*	DSA301LA	SURGE ABSORBER		
144	1E	*	W02-0855-05	ENCODER(MAIN)		
145	1E	*	W02-0857-15	ENCODER(SUB)		
150	1D,3J	*	X41-3080-00	SWITCH(A) UNIT		

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151	1D,1E	*	X41-3090-00	SWITCH(B) UNIT		
152	2H,2I	*	X43-3070-01	AVR UNIT		
153	3G	*	X44-3100-00	RF UNIT		
154	2K	*	X45-3330-00	FINAL UNIT		
155	3F	*	X46-3050-[illegible]	DIGITAL UNIT	KP	
155	3F	*	X46-3050-21	DIGITAL UNIT	M	
155	3F	*	X46-3050-61	DIGITAL UNIT	W	
155	3F	*	X46-3050-62	DIGITAL UNIT	W2	
155	3F	*	X46-3050-71	DIGITAL UNIT	X	
156	3G	*	X48-3060-00	IF UNIT		
157	3F	*	X49-3020-00	AF UNIT		
158	1F	*	X50-3100-00	PLL UNIT		
159	1G	*	X50-3110-00	CAR UNIT		S
159	1G	*	X50-3110-01	CAR UNIT		D
-			X51-3050-00	FILTER UNIT(YG-455C-1)		D
161	2K	*	X51-3060-01	FILTER UNIT	KMWXP	S
161	2K	*	X51-3060-11	FILTER UNIT	KMWXP	D
161	2K	*	X51-3060-61	FILTER UNIT	W2	S
161	2K	*	X51-3060-62	FILTER UNIT	W2	D
-		*	X51-3070-00	FILTER UNIT(YG-455S-1)		D
-		*	X51-3080-00	FILTER UNIT(YG-455CN-1)		D
163	2F	*	X53-3230-00	CONTROL UNIT		
164	1L	*	X53-3240-00	AT UNIT		
165	2B	*	X53-3260-00	DSP UNIT		D
166	1E	*	X54-3080-00	DISPLAY UNIT		
167	3F	*	X57-3380-00	SIGNAL UNIT		
SWITCH UNIT (A) (X41-3080-00)						
C1 -4			CK73FB1H102K	CHIP C 1000PF K		
C5			CE04EW1C470M	ELECTRO 47UF 16WV		
C6			CE04EW1H010M	ELECTRO 1.0UF 50WV		
C7			CE04EW1C330M	ELECTRO 33UF 16WV		
C8 -10			CK73FB1H102K	CHIP C 1000PF K		
C11			CE04EW1H100M	ELECTRO 10UF 50WV		
C12 -15			CK73FB1H103K	CHIP C 0.010UF K		
C16			CE04EW1C220M	ELECTRO 22UF 16WV		
C17 -20			CK73FB1H103K	CHIP C 0.010UF K		
C21			CE04EW1C220M	ELECTRO 22UF 16WV		
C22 -25			CC73FSL1HXXXJ	CHIP C		
C26 -28			CK73FB1HXXXK	CHIP C		
C29			CK73EF1C105Z	CHIP C 1.0UF Z		
C30			CK73FF1E104K	CHIP C 0.1UF K		
C31			CK73FB1H103K	CHIP C 0.010UF K		
C32 -34			CC73FSL1H101J	CHIP C 100PF J		
C35 ,36			CK73FB1H103K	CHIP C 0.010UF K		
		*	E23-0623-04	TERMINAL		
CN1			E40-3239-05	PIN CONNECTOR(4P)		
CN2		*	E40-5135-05	PIN CONNECTOR(20P)		
CN3			E40-3238-05	PIN CONNECTOR(3P)		
CN4			E40-3240-05	PIN CONNECTOR(5P)		
CN5			E40-3237-05	PIN CONNECTOR(2P)		
CN6			E40-5133-05	PIN CONNECTOR(18P)		
CN7			E40-3238-05	PIN CONNECTOR(3P)		
CN8			E23-0401-05	TERMINAL		
CN9			E40-3237-05	PIN CONNECTOR(2P)		

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CN10			E40-3239-05	PIN CONNECTOR(4P)		
CN11			E40-3238-05	PIN CONNECTOR(3P)		
CN12			E40-3299-05	PIN CONNECTOR(2P)		
CN13			E23-0401-05	TERMINAL		
CN14		*	E40-3306-05	PIN CONNECTOR(9P)		
CN15			E40-3302-05	PIN CONNECTOR(5P)		
CN16			E40-3304-05	PIN CONNECTOR(7P)		
CN17			E40-3301-05	PIN CONNECTOR(4P)		
CN18			E40-3304-05	PIN CONNECTOR(7P)		
CN19			E40-3299-05	PIN CONNECTOR(2P)		
CN20			E40-3303-05	PIN CONNECTOR(6P)		
CN21			E23-0401-05	TERMINAL		
CN22			E40-3239-05	PIN CONNECTOR(4P)		
CN23			E40-3238-05	PIN CONNECTOR(3P)		
CN24			E23-0401-05	TERMINAL		
CN25			E40-3243-05	PIN CONNECTOR(8P)		
CN26			E40-3239-05	PIN CONNECTOR(4P)		
CN27			E40-3241-05	PIN CONNECTOR(6P)		
CN28			E40-3237-05	PIN CONNECTOR(2P)		
CN29			E40-3242-05	PIN CONNECTOR(7P)		
CN30			E40-3239-05	PIN CONNECTOR(4P)		
CN31			E40-3237-05	PIN CONNECTOR(2P)		
CN32			E40-3240-05	PIN CONNECTOR(5P)		
CN33,34			E23-0401-05	TERMINAL		
J1			E06-0858-15	8P METAL RECEPTACLE(MIC)		
L1 -5			L40-1011-17	SMALL FIXED INDUCTOR(100UH)		
L6			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
R1 -44			RK73FB2AXXXJ	CHIP R		
VR1			R19-3423-05	POTENTIOMETER 10K(PROCESSOR)		
VR2		*	R24-3406-05	POTENTIOMETER 10K(POWER)		
VR3		*	R05-5402-05	POTENTIOMETER 100K(KEY SPEED)		
VR4		*	R05-3449-05	POTENTIOMETER 10K(MONITOR)		
VR5		*	R10-6401-05	POTENTIOMETER 250K(VOX DELAY)		
VR6		*	R05-0403-05	POTENTIOMETER 500(ANTIVOX)		
VR7		*	R05-3449-05	POTENTIOMETER 10K(VOX GAIN)		
VR8 ,9		*	R05-3451-05	POTENTIOMETER 10K(R.X-TUNE)		
VR10		*	R05-4426-05	POTENTIOMETER 50K(DIMMER)		
VR11		*	R05-3451-05	POTENTIOMETER 10K(CAR LEVEL)		
VR12		*	R24-1401-05	POTENTIOMETER 1K(NB LEVEL)		
S1 -4			S50-1412-05	SENSITIVE SWITCH(SWR,COMP,IC		
S5 ,6		*	S40-1428-05	PUSH SWITCH(VOICE,8.83)		
S7 ,8		*	S40-1429-05	PUSH SWITCH(LSB,CW		
S9		*	S40-1430-05	PUSH SWITCH(AM)		
S10 ,11		*	S40-1428-05	PUSH SWITCH(DATA,455)		
S12 ,13		*	S40-1429-05	PUSH SWITCH(USB,FSK)		
S14		*	S40-1430-05	PUSH SWITCH(FM)		
S15 ,16		*	S40-1428-05	PUSH SWITCH(F-LOCK,TF-S)		
S17 -19		*	S40-1429-05	PUSH SWITCH(RXA,RXB,RXM)		
S20 -22		*	S40-1428-05	PUSH SWITCH(A=B,DOWN,TONE)		
S23 -25		*	S40-1429-05	PUSH SWITCH(TXA,TXB,TXM)		
S26 -28		*	S40-1428-05	PUSH SWITCH(RX>S,UP,TF-W)		
S29 -31		*	S40-1429-05	PUSH SWITCH(1,4,7)		
S32 -34		*	S40-1428-05	PUSH SWITCH(CLR,MIN,SUB)		
S35 -38		*	S40-1429-05	PUSH SWITCH(2,5,8,0)		

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S39 ,40		*	S40-1428-05	PUSH SWITCH(M>V,STEP)		
S41 -43		*	S40-1429-05	PUSH SWITCH(3,6,9)		
S44 ,45		*	S40-1428-05	PUSH SWITCH(ENT,SCAN)		
S46 -52			S40-2440-15	PUSH SWITCH(MANU/VOX ETC)		
S53 -55			S40-2441-15	PUSH SWITCH(RIT,XIT,SIC		
S56 ,57			S40-2440-15	PUSH SWITCH(NOTCH,AF VBT)		
S58			S40-2441-15	PUSH SWITCH(AIP)		
S59 -61			S40-2440-15	PUSH SWITCH(PROC,NB1,NB2)		
S62 ,63		*	S31-2416-05	SLIDE SWITCH MANUAL/AUTO,CAL)		
D1 -7			RLS73	CHIP DIODE		
D8 ,9			LN01301C(Q)	LED(AIP,NOTCH)		
D10			LN01401C	LED(AT TUNE)		
D11			LN01201C	LED(ON AIR)		
D12			RLS73	CHIP DIODE		
D13		*	RLZJ10B	CHIP ZENER DIODE		
D14			RLS73	CHIP DIODE		
IC1			TC4066BP	IC(ANALOG/ DIGITAL SW)		
IC2			NE555P	IC		
Q1 -15			DTC143EK	DIGITAL TRANSISTOR		
Q16			DTC143TK	DIGITAL TRANSISTOR		
Q17			2SC3324(G)	CHIP TRANSISTOR		
		*	X59-3710-00	MODULE UNIT(MIC AMP)		
SWITCH UNIT (B) (X41-3090-00)						
C1 ,2			CK45B1H102K	CERAMIC 1000PF K		
CN1			E40-3304-05	PIN CONNECTOR(7P)		
CN2			E40-3301-05	PIN CONNECTOR(4P)		
CN3			E40-3300-05	PIN CONNECTOR(3P)		
CN4			E40-3238-05	PIN CONNECTOR(3P)		
CN5			E40-3301-05	PIN CONNECTOR(4P)		
CN6			E40-3300-05	PIN CONNECTOR(3P)		
CN7			E40-3301-05	PIN CONNECTOR(4P)		
CN8			E40-3299-05	PIN CONNECTOR(2P)		
CN9			E40-3241-05	PIN CONNECTOR(6P)		
CN10			E40-3300-05	PIN CONNECTOR(3P)		
CN11			E40-3303-05	PIN CONNECTOR(6P)		
CN12			E40-3302-05	PIN CONNECTOR(5P)		
CN13			E40-3299-05	PIN CONNECTOR(2P)		
J1		*	E11-0437-05	PHONE JACK		
W1 ,2		*	E31-6065-15	CONNECTING WIRE		
R1			RD14BB2C102J	RD 1.0K J 1/6W		
R2			RD14BB2C683J	RD 68K J 1/6W		
R3			RD14BB2C332J	RD 3.3K J 1/6W		
R4			RD14BB2C183J	RD 18K J 1/6W		
R5 ,6			RD14BB2C472J	RD 4.7K J 1/6W		
R7 ,8			RD14CB2E101J	RD 100 J 1/4W		
R9			RD14BB2C471J	RD 470 J 1/6W		
R10			RD14BB2C223J	RD 22K J 1/6W		
VR1		*	R24-3405-05	POTENTIOMETER 10K(NOTCH/SQ)		
VR2		*	R19-3426-05	POTENTIOMETER 10K(SUB AF/PITCH		
VR3		*	R19-3427-05	POTENTIOMETER 10K(AF/RF GAIN)		
VR4		*	R19-9413-05	POTENTIOMETER 10K/50K(IF,AF,VB		
VR5			R12-1085-05	TRIMMING POT. 2.2K(IF VBT)		
VR6		*	R19-3428-05	POTENTIOMETER 10K(SLOPE TUNE)		

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VR7 -9			R12-1085 05	TRIMMING POT. 2.2K(SLOPE TUNE)				
S1		*	S29-1441-05	ROTARY SWITCH(ATT)				
S2		*	S29-1442-05	ROTARY SWITCH(AGC)				
S3		*	W02 0858 05	ENCODER(RIT/XIT)				
S4		*	W02-0859-05	ENCODER(M.CH/VFO CH)				
AVR UNIT (X43-3070-01)								
C1		*	CK73EF1H224Z	CHIP C	0.22UF	Z		
C2			CK73FF1E473Z	CHIP C	0.047UF	Z		
C3 ,4		*	C90 2110-05	ELECTRO	3300UF	35WV		
C5		*	CK73EF1H104Z	CHIP C	0.10UF	Z		
C6			CK73FF1E473Z	CHIP C	0.047UF	Z		
C7 ,8			CK73FF1H103Z	CHIP C	0.010UF	Z		
C9			CK73FB1H102K	CHIP C	1000PF	K		
C10		*	C90-2109-05	ELECTRO	4700UF	25WV		
C11			CK73FF1E473Z	CHIP C	0.047UF	Z		
C12			CE04EW1E471M	ELECTRO	470UF	25WV		
C13			CK73FF1H103Z	CHIP C	0.010UF	Z		
C14 -16			CE04EW1E101M	ELECTRO	100UF	25WV		
C17 -22			CK73FF1E104Z	CHIP C	0.10UF	Z		
C23 -25			CE04EW1E101M	ELECTRO	100UF	25WV		
C26 -29			CK45E2H103P	CERAMIC	0.010UF	P		
C30		*	C90-2111-05	ELECTRO	1000UF	80WV		
C31			CK45E2H103P	CERAMIC	0.010UF	P		
C32 ,33			CK73FF1H103Z	CHIP C	0.010UF	Z		
C34		*	CE04EW1J101M	ELECTRO	100UF	63WV		
C35 -38		*	CK73EF1H224Z	CHIP C	0.22UF	Z		
C39			CE04EW1E102M	ELECTRO	1000UF	25WV		
C40			CK73FF1E104Z	CHIP C	0.10UF	Z		
C41			CK73FB1H222K	CHIP C	2200PF	K		
C42			CK73EF1E474Z	CHIP C	0.47UF	Z		
C43			CE04EW1C471M	ELECTRO	470UF	16WV		
C44			C91-0647-05	CERAMIC	0.01UF	P		
C45 ,46			C91-1075-05	CERAMIC	470PF	K		
C47 -54			CK45E2H103P	CERAMIC	0.010UF	P		
C55 -62		*	CK73EF1H224Z	CHIP C	0.22UF	Z		
C63 -65			CK73FF1H103Z	CHIP C	0.010UF	Z		
C66		*	C90-2113-05	ELECTRO	22000UF	80WV		
C67			CK45E2H103P	CERAMIC	0.010UF	P		
C68		*	C90-2112-05	ELECTRO	22000UF	35WV		
C69 ,70			CK73FF1H103Z	CHIP C	0.010UF	Z		
C101			CE04EW1H100M	ELECTRO	10UF	50WV		
C102			CK73FB1H103K	CHIP C	0.010UF	K		
			E23-0159-05	TERMINAL				
			E23-0198-05	TERMINAL				
			E23-0401-05	TERMINAL				
CN1			E40-0370-05	PIN CONNECTOR(3P)				
CN2 ,3			E40-3237-05	PIN CONNECTOR(2P)				
CN4			E40-3238-05	PIN CONNECTOR(3P)				
CN5			E40-3240-05	PIN CONNECTOR(5P)				
CN6			E40-3243-05	PIN CONNECTOR(8P)				
CN7			E40-0342 05	PIN CONNECTOR(3P)				
CN8			E40-3241-05	PIN CONNECTOR(6P)				

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CN9 ,10			E40-0470-05	PIN CONNECTOR 4P		
CN11			E40-3238-05	PIN CONNECTOR(3P)		
CN12			E40-3237-05	PIN CONNECTOR 2P		
CN13			E40-0442-05	PIN CONNECTOR(4P)		
CN14			E40-3238-05	PIN CONNECTOR 3P		
CN101			E23-0401-05	TERMINAL		
TP1			E23-0467-05	TERMINAL		
F1			F05-7521-05	FUSE(7.5A)		
		*	G13-0934-04	CUSHION		
			J13-0055-05	FUSE HOLDER(TRANS 1ST STAGE)		
			J13-0410-05	FUSE HOLDER(TRANS 2ND STAGE)		
R1			RS14KB3A2R2J	FL-PROOF RS 2.2 J 1W		
R2 -3			RK73FB2AXXXJ	CHIP R		
R4		*	RS14KB3F151J	FL-PROOF RS 150 J 3W		
R5 ,6			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R7		*	RS14KB3F181J	FL-PROOF RS 180 J 3W		
R8 -10			RK73FB2AXXXJ	CHIP R		
R11			RS14KB3A820J	FL-PROOF RS 82 J 1W		
R12			R014BB2E681J	RD 680 J 1/4W		
R13			RS14KB3A2R2J	FL-PROOF RS 2.2 J 1W		
R14			RK73EB2B223J	CHIP R 22K J 1/8W		
R15		*	RS14KB3F103J	FL-PROOF RS 10K J 3W		
R16			RS14KB3A820J	FL PROOF RS 82 J 1W		
R17			RS14KB3D100J	FL-PROOF RS 10 J 2W		
R19 -23		*	RK73EB2BXXXJ	CHIP R		
R24 -103			RK73FB2AXXXJ	CHIP R		
R104			RS14KB3F150J	RS 15 J 3W		
R105			RS14KB3F180J	RS 18 J 3W		
VR1		*	R12-0105-05	TRIMMING POT.220 OHM		
S1		*	S59-1412-05	THERMAL SWITCH(80°C)		
S2		*	S59-1411-05	THERMAL SWITCH(50°C)		
D1		*	1B2C1(LC1)	DIODE		
D2			RLS73	CHIP DIODE		
D3		*	RLZ7.5B	CHIP ZENER DIODE(7.5V)		
D4		*	UZP6.2B	ZENER DIODE(6.2V)		
D5 ,6			S1WB10	DIODE		
D7 ,8		*	RLZ20C	CHIP ZENER DIODE(20V)		
D9			S15VB20	DIODE		
D10			S15VB10	DIODE		
D101			RLS73	CHIP DIODE		
D102			RLZ15B	CHIP DIODE		
D103		*	SF8GZ47	THYRISTOR		
IC1 -3			UPC7805H	IC(VOLTAGE REGULATOR/ +5V)		
IC4			UPC7912HF	IC(VOLTAGE REGULATOR/ -12V)		
Q1		*	2SB941(Q)	TRANSISTOR		
Q2		*	2SC3907(O)	TRANSISTOR		
Q3			2SD1624S	TRANSISTOR		
Q4			2SC2712(Y)	TRANSISTOR		
Q5			2SA1358(Y)	TRANSISTOR		
Q101			DTC114EK	DIGITAL TRANSISTOR		
Q102			2SA1358(Y)	TRANSISTOR		

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RF UNIT (X44-3100-00)						
C1 -3			CK73FB1E103K	CHIP C 0.010UF K		
C4			CK73FB1H102K	CHIP C 1000PF K		
C5			CK73FF1E104Z	CHIP C 0.10UF Z		
C6 -7			CC73FCH1HXXXJ	CHIP C		
C8			CC73FSL1H151J	CHIP C 150PF J		
C9 10			CC73FCH1HXXXJ	CHIP C		
C11 ,12			CK73FF1E104Z	CHIP C 0.10UF Z		
C13			CE04EW1C220M	ELECTRO 22UF 16WV		
C14 17			CK73FB1H102K	CHIP C 1000PF K		
C18 20			CK73FF1E104Z	CHIP C 0.10UF Z		
C21			CE04EW1C220M	ELECTRO 22UF 16WV		
C22 -25			CK73FB1HXXXK	CHIP C		
C26			CE04EW1C220M	ELECTRO 22UF 16WV		
C27			CK73FF1E104Z	CHIP C 0.10UF Z		
C28 -30			CC73FSL1HXXXJ	CHIP C		
C31 -32			CK73FB1EXXXK	CHIP C		
C33			CK73FB1H682K	CHIP C 6800PF K		
C34 -36			CC73FSL1HXXXJ	CHIP C		
C37			CK73FF1E104Z	CHIP C 0.10UF Z		
C38			CE04EW1C220M	ELECTRO 22UF 16WV		
C39			CK73FF1E104Z	CHIP C 0.10UF Z		
C40 -42			CC73FSL1HXXXJ	CHIP C		
C43			CK73FF1E104Z	CHIP C 0.10UF Z		
C44			CE04EW1C220M	ELECTRO 22UF 16WV		
C45			CK73FF1E104Z	CHIP C 0.10UF Z		
C46 -48			CC73FSL1HXXXJ	CHIP C		
C49			CK73FF1E104Z	CHIP C 0.10UF Z		
C50			CE04EW1C220M	ELECTRO 22UF 16WV		
C51			CK73FF1E104Z	CHIP C 0.10UF Z		
C52			CC73FSL1H561J	CHIP C 560PF J		
C53			CC73FCH1H270J	CHIP C 27PF J		
C54			CC73FSL1H471J	CHIP C 470PF J		
C55			CK73FF1E104Z	CHIP C 0.10UF Z		
C56			CE04EW1C220M	ELECTRO 22UF 16WV		
C57			CK73FF1E104Z	CHIP C 0.10UF Z		
C58			CC73FSL1H221J	CHIP C 220PF J		
C59			CC73FCH1H470J	CHIP C 47PF J		
C60			CC73FSL1H121J	CHIP C 120PF J		
C61			CK73FF1E104Z	CHIP C 0.10UF Z		
C62			CE04EW1C220M	ELECTRO 22UF 16WV		
C63			CK73FF1E104Z	CHIP C 0.10UF Z		
C64			CC73FSL1H471J	CHIP C 470PF J		
C65			CC73FCH1H180J	CHIP C 18PF J		
C66			CC73FSL1H331J	CHIP C 330PF J		
C67			CK73FF1E104Z	CHIP C 0.10UF Z		
C68			CE04EW1C220M	ELECTRO 22UF 16WV		
C69			CK73FF1E104Z	CHIP C 0.10UF Z		
C70			CC73FSL1H181J	CHIP C 180PF J		
C71			CC73FCH1H330J	CHIP C 33PF J		
C72			CK73FF1E104Z	CHIP C 0.10UF Z		
C73			CE04EW1C220M	ELECTRO 22UF 16WV		
C74			CK73FF1E104Z	CHIP C 0.10UF Z		
C75 -77			CC73FSL1HXXXJ	CHIP C		

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C78			CK73FF1E104Z	CHIP C	0.10UF Z		
C79			CE04EW1C220M	ELECTRO	22UF 16WV		
C80			CK73FF1E104Z	CHIP C	0.10UF Z		
C81			CC73FSL1H221J	CHIP C	220PF J		
C82 ,83			CC73FCH1H180J	CHIP C	18PF J		
C84			CK73FF1E104Z	CHIP C	0.10UF Z		
C85			CE04EW1C220M	ELECTRO	22UF 16WV		
C86			CK73FF1E104Z	CHIP C	0.10UF Z		
C87			CC73FSL1H221J	CHIP C	220PF J		
C89			CC73FCH1H680J	CHIP C	68PF J		
C90			CK73FF1E104Z	CHIP C	0.10UF Z		
C91			CE04EW1C220M	ELECTRO	22UF 16WV		
C92			CK73FF1E104Z	CHIP C	0.10UF Z		
C93			CC73FSL1H221J	CHIP C	220PF J		
C94			CC73FCH1H080D	CHIP C	8.0PF D		
C96			CK73FF1E104Z	CHIP C	0.10UF Z		
C97			CE04EW1C220M	ELECTRO	22UF 16WV		
C98			CK73FF1E104Z	CHIP C	0.10UF Z		
C99			CC73FSL1H151J	CHIP C	150PF J		
C100			CC73FCH1H080D	CHIP C	8.0PF D		
C101			CK73FF1E104Z	CHIP C	0.10UF Z		
C102			CE04EW1C220M	ELECTRO	22UF 16WV		
C103			CK73FF1E104Z	CHIP C	0.10UF Z		
C104-106			CC73FCH1H150J	CHIP C	15PF J		
C107			CK73FF1E104Z	CHIP C	0.10UF Z		
C108			CE04EW1C220M	ELECTRO	22UF 16WV		
C109-116			CK73FF1E104Z	CHIP C	0.10UF Z		
C117,118			CE04EW1H010M	ELECTRO	1.0UF 50WV		
C119			CE04EW1E4R7M	ELECTRO	4.7UF 25WV		
C121			CC73FCH1H101J	CHIP C	100PF J		
C122			CK73FF1E104Z	CHIP C	0.10UF Z		
C123			CE04EW1C220M	ELECTRO	22UF 16WV		
C124,125			CK73FF1E104Z	CHIP C	0.10UF Z		
C126			CE04EW1C470M	ELECTRO	47UF 16WV		
C127			CK73FF1E104Z	CHIP C	0.10UF Z		
C128			CE04EW1C220M	ELECTRO	22UF 16WV		
C129-131			CK73FF1E104Z	CHIP C	0.10UF Z		
C132			CE04EW1C220M	ELECTRO	22UF 16WV		
C133 135			CK73FF1E104Z	CHIP C	0.10UF Z		
C136-138			CC73FCH1HXXXJ	CHIP C			
C139-141			CK73FF1E104Z	CHIP C	0.10UF Z		
C142-143			CC73FCH1HXXXJ	CHIP C			
C144			CC73FSL1H151J	CHIP C	150PF J		
C145-146			CC73FCH1HXXXJ	CHIP C			
C147-149			CK73FF1E104Z	CHIP C	0.10UF Z		
C150			CE04EW1C220M	ELECTRO	22UF 16WV		
C151-153			CK73FF1E104Z	CHIP C	0.10UF Z		
C154			CK73FB1E103K	CHIP C	0.010UF K		
C156			CK73FF1E104Z	CHIP C	0.10UF Z		
C159-161			CC73FCH1HXXXD	CHIP C			
C162-165			CK73FB1E103K	CHIP C	0.010UF K		
C166-168			CK73FF1E104Z	CHIP C	0.10UF Z		
C169-170			CC73FCH1HXXXJ	CHIP C			
C171			CC73FSL1H151J	CHIP C	150PF J		
C172-173			CC73FCH1HXXXJ	CHIP C			

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C174			CE04EW1C220M	ELECTRO	22UF 16WV		
C175 177			CK73FF1E104Z	CHIP C	0.10UF Z		
C179-185			CK73FB1HXXXK	CHIP C			
C186-187			CC73FCH1HXXXC	CHIP C			
C188,189			CK73FF1E104Z	CHIP C	0.10UF Z		
C190			CK73FB1H102K	CHIP C	1000PF K		
C191			CK73FF1E104Z	CHIP C	0.10UF Z		
C192			CK73FB1H102K	CHIP C	1000PF K		
C193			CE04EW1H010M	ELECTRO	1UF 50WV		
C194-196			CK73FF1E104Z	CHIP C	0.10UF Z		
C197,198			CK73FB1H102K	CHIP C	1000PF K		
C199			CK73FB1E103K	CHIP C	0.010UF K		
C200			CK73FF1E104Z	CHIP C	0.10UF Z		
C201			CK73FB1E103K	CHIP C	0.010UF K		
C203			CC73FCH1H330J	CHIP C	33PF J		
C204-205			CC73FSL1HXXXJ	CHIP C			
C206,207			CK73FB1E103K	CHIP C	0.010UF K		
C208-209			CC73FSL1HXXXJ	CHIP C			
C210			CK73FF1E104Z	CHIP C	0.10UF Z		
C211			CC73FCH1H680J	CHIP C	68PF J		
C212,213			CK73FB1E103K	CHIP C	0.010UF K		
C214-216			CC73FCH1HXXXJ	CHIP C			
C219,220			CK73FB1E103K	CHIP C	0.010UF K		
C221-225			CK73FF1E104Z	CHIP C	0.10UF Z		
C222			CK73FB1E103K	CHIP C	0.010UF K		
C226,227			CK73FF1E104Z	CHIP C	0.10UF Z		
C228-230			CC73FCH1HXXXJ	CHIP C			
C232-234			CK73FF1EXXXZ	CHIP C			
C235,236			CC73FCH1H680J	CHIP C	68PF J		
C237			CK73FB1E103K	CHIP C	0.010UF K		
C238			CK73FF1E104Z	CHIP C	0.10UF Z		
C239			CK73FB1E103K	CHIP C	0.010UF K		
C240			CK73FF1E104Z	CHIP C	0.10UF Z		
C241			CK73FB1E103K	CHIP C	0.010UF K		
C242			CC45CH1H220J	CERAMIC C	22PF J		
TC1			C05-0315-05	TRIMMING CAP 60PF			
CN1			E04-0157-05	RF COAXIAL JACK(TIF)			
CN2			E40-3237-05	PIN CONNECTOR(2P)			
CN3 ,4			E04-0157-05	RF COAXIAL JACK(M,S VCO)			
CN5			E40-3239-05	PIN CONNECTOR(4P)			
CN6			E40-3241-05	PIN CONNECTOR(6P)			
CN7			E04-0157-05	RF COAXIAL JACK(MIF)			
CN8		*	E13-0261-05	PHONO JACK(RX ANT,DRV)			
CN9			E40-3239-05	PIN CONNECTOR(4P)			
CN10			E04-0157-05	RF COAXIAL JACK(SIF)			
TP1 -4			E23-0512-05	TERMINAL			
A1 ,2		*	F11-0770-14	SHIELDING COVER			
L1			L40-2282-13	SMALL FIXED INDUCTOR(0.22UH)			
L2		*	L40-2782-13	SMALL FIXED INDUCTOR(0.27UH)			
L3			L19-0324-05	BALUN TRANSFORMER			
L4			L40-1021-14	SMALL FIXED INDUCTOR(1MH)			
L5 -9			L40-1001-19	SMALL FIXED INDUCTOR(10UH)			
L10			L40-1021-14	SMALL FIXED INDUCTOR(1MH)			

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L11 ,12			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L13		*	L40-8201-14	SMALL FIXED INDUCTOR(82UH)		
L14			L40-4701-14	SMALL FIXED INDUCTOR(47UH)		
L15			L40-5601-14	SMALL FIXED INDUCTOR(56UH)		
L16			L40-8291-14	SMALL FIXED INDUCTOR(8.2UH)		
L17			L40-1501-14	SMALL FIXED INDUCTOR(15UH)		
L18			L40-8291-14	SMALL FIXED INDUCTOR(8.2UH)		
L19		*	L34-4164-05	COIL(B.P.F 3-4MHZ) 4.7UH		
L20		*	L34-4176-05	COIL(B.P.F 3-4MHZ) 15UH		
L21		*	L34-4164-05	COIL(B.P.F 3-4MHZ) 4.7UH		
L22			L40-3391-14	SMALL FIXED INDUCTOR(3.3UH)		
L23			L40-6891-14	SMALL FIXED INDUCTOR(6.8UH)		
L24			L40-3391-14	SMALL FIXED INDUCTOR(3.9UH)		
L25		*	L34-4146-05	COIL(B.P.F 7-7.5MHZ) 0.82UH		
L26		*	L34-4178-05	COIL(B.P.F 7-7.5MHZ) 18UH		
L27		*	L34-4146-05	COIL(B.P.F 7-7.5MHZ) 0.82UH		
L28			L40-1292-14	SMALL FIXED INDUCTOR(1.2UH)		
L29			L40-6891-14	SMALL FIXED INDUCTOR(6.8UH)		
L30			L40-1292-14	SMALL FIXED INDUCTOR(1.2UH)		
L31		*	L34-4140-05	COIL(B.P.F 10-10.5MHZ)0.47UH		
L32		*	L34-4175-05	COIL(B.P.F 10-10.5MHZ)13UH		
L33		*	L34-4140-05	COIL(B.P.F 10-10.5MHZ)0.47UH		
L34			L40-8282-14	SMALL FIXED INDUCTOR(0.82UH)		
L35			L40-5691-14	SMALL FIXED INDUCTOR(5.6UH)		
L36			L40-8282-14	SMALL FIXED INDUCTOR(0.82UH)		
L37		*	L34-4136-05	COIL(B.P.F 14-14.5MHZ)0.33UH		
L38		*	L34-4172-05	COIL(B.P.F 14-14.5MHZ)10UH		
L39		*	L34-4136-05	COIL(B.P.F 14-14.5MHZ)0.33UH		
L40			L40-4782-14	SMALL FIXED INDUCTOR(0.47UH)		
L41			L40-5691-14	SMALL FIXED INDUCTOR(5.6UH)		
L42			L40-3982-14	SMALL FIXED INDUCTOR(0.39UH)		
L43			L40-3382-14	SMALL FIXED INDUCTOR(0.33UH)		
L44			L40-5691-14	SMALL FIXED INDUCTOR(5.6UH)		
L45			L40-2782-14	SMALL FIXED INDUCTOR(0.27UH)		
L46		*	L34-4132-05	COIL(B.P.F 21-21.5MHZ)0.22UH		
L47		*	L34-4166-05	COIL(B.P.F 21-21.5MHZ)4.7UH		
L48		*	L34-4132-05	COIL(B.P.F 21-21.5MHZ)0.22UH		
L49			L40-2782-14	SMALL FIXED INDUCTOR(0.27UH)		
L50			L40-5691-14	SMALL FIXED INDUCTOR(5.6UH)		
L51			L40-2282-14	SMALL FIXED INDUCTOR(0.22UH)		
L52		*	L34-4192-05	COIL(B.P.F 24.5-30MHZ)		
L53		*	L34-4193-05	COIL(B.P.F 24.5-30MHZ)		
L54		*	L34-4194-05	COIL(B.P.F 24.5-30MHZ)		
L55 ,56			L40-4711-14	SMALL FIXED INDUCTOR(470UH)		
L57 -59			L40 1021-14	SMALL FIXED INDUCTOR(1MH)		
L60 ,61			L19-0324-05	BALUN TRANSFORMER		
L62			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L63			L19-0324-05	BALUN TRANSFORMER		
L64			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L65			L19-0324-05	BALUN TRANSFORMER		
L66			L40-4782-17	SMALL FIXED INDUCTOR(0.47UH)		
L67			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L68			L34-4046-15	COIL		
L69			L34-0895-05	COIL		
L70			L19-0344-05	BALUN TRANSFORMER		

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L71			L40 1021-14	SMALL FIXED INDUCTOR(1MH)		
L72			L40 2782 14	SMALL FIXED INDUCTOR(0.27UH)		
L73			L40 2282 14	SMALL FIXED INDUCTOR(0.22UH)		
L74			L40-1021-14	SMALL FIXED INDUCTOR(1MH		
L75			L19-0324-05	BALUN TRANSFORMER		
L76			L40-1001-14	SMALL FIXED INDUCTOR(10UH)		
L77			L34-2267 05	COIL(SUB IFT)		
L78			L34-4047-05	COIL(SUB IFT)		
L79			L34-4048-05	COIL(SUB IFT)		
L80			L34-4047-05	COIL(SUB IFT)		
L81		*	L39-0454-05	TROIDAL COIL		
L82 ,83			L40 1021 14	SMALL FIXED INDUCTOR(1MH)		
L84			L40-2782-14	SMALL FIXED INDUCTOR(0.27UH)		
L85			L40-2282-14	SMALL FIXED INDUCTORO.22UH)		
L86			L19-0324-05	BALUN TRANSFORMER		
L87		*	L34-4222-05	COIL(MAIN IFT)		
L88			L40 4791 14	SMALL FIXED INDUCTOR(4.7UH)		
L89		*	L39-0454-05	TROIDAL COIL		
L90		*	L39-0455-05	TROIDAL COIL		
L91 ,92		*	L39 0454-05	TROIDAL COIL		
L93		*	L34-4211-05	COIL(TIF)		
L94 ,95		*	L34-4190-05	COIL(TIF)		
L96			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L97			L40-2292-17	SMALL FIXED INDUCTOR(2.2UH)		
L98			L40-3391-17	SMALL FIXED INDUCTOR(3.3UH)		
L99			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L100			L40-1892-17	SMALL FIXED INDUCTOR(1.8UH)		
L101			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L102-104			L40-6882-17	SMALL FIXED INDUCTOR(0.68UH)		
L105			L40 1021-14	SMALL FIXED INDUCTOR(1MH)		
L106			L40-6882-17	SMALL FIXED INDUCTOR(0.68UH)		
L107			L40-4782-17	SMALL FIXED INDUCTOR(0.47UH)		
L108			L39-0432-05	TROIDAL COIL		
L109			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L110			L39-0454-05	TROIDAL COIL		
L111			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L112-114			L40-2292-14	SMALL FIXED INDUCTOR(2.2UH)		
XF1			L71-0275-05	CRYSTAL FILTER(40.055MHZ)		
R1 -84			RK73FB2AXXXJ	CHIP R		
R85			RD14BB2C560J	RD 56 J 1/6W		
R86 -187			RK73FB2AXXXJ	CHIP R		
R188			RD14BB2C682J	RD 6.8K J 1/6W		
VR1 ,2			R12-1089-05	TRIMMING POT. 4.7K		
VR3			R12-0108-05	TRIMMING POT. 470		
VR4 -6			R12-3133-05	TRIMMING POT. 47K		
W1			R92-1061-05	JUMPER REST 0 OHM		
K1 ,2			S51-1436 05	RELAY		
D1 ,2			RLS73	CHIP DIODE		
D3		*	RLZJ5.1B	CHIP ZENER DIODE(5.1V)		
D4 ,5			US1090	CHIP DIODE		
D6 -36			RLS135	CHIP DIODE		
D37 ,38			MI204	DIODE		
D39			RLS135	CHIP DIODE		

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D40 ,41			LT8001P	LED		
D42 -45			RLS135	CHIP DIODE		
D46 ,47			RLS73	CHIP DIODE		
D48 -57			RLS135	CHIP DIODE		
D58 -60			RLS73	CHIP DIODE		
D61 ,62			DAN202(K)	CHIP DIODE		
D63			DSP-301N	DIODE		
D64			RLS135	CHIP DIODE		
D65			1SS133	DIODE		
IC1 ,2			SN74LS145N	IC(DUAL MONO MALTI)		
Q1 ,2			2SA1162(Y)	CHIP TRANSISTOR		
Q3			2SC2712(Y)	CHIP TRANSISTOR		
Q4 ,5			2SK125-5	FET		
Q6		*	2SK520(K43)	CHIP FET		
Q7 -16		*	2SK520(K44)	CHIP FET		
Q17 -19			2SC2954(QK)	CHIP TRANSISTOR		
Q20 -22			3SK131(M)	CHIP FET		
Q23			DTC114EK	DIGITAL TRANSISTOR		
Q24 -28			DTC124EK	DIGITAL TRANSISTOR		
Q29 ,30			DTA114EK	DIGITAL TRANSISTOR		
Q31 -35			DTA124EK	DIGITAL TRANSISTOR		
Q37			2SC2712(Y)	CHIP TRANSISTOR		
TH1			112-302-2	THERMISTOR 3K		
FINAL UNIT (X45-3330-00)						
C1			CK45B1H561K	CERAMIC 560PF K		
C2			CK45B1H102K	CERAMIC 1000PF K		
C3			C91-0119-05	CERAMIC 0.047UF K		
C4			CK45F1H103Z	CERAMIC 0.010UF Z		
C5 ,6			CK45F1H223Z	CERAMIC 0.022UF Z		
C7			CE04EW1H100M	ELECTRO 10UF 50WV		
C8		*	CE04EW1H471M	ELECTRO 470UF 50WV		
C9 ,10			CK45F1H223Z	CERAMIC 0.022UF Z		
C11			C91-0119-05	CERAMIC 0.047UF K		
C12			CE04EW1H100M	ELECTRO 10UF 50WV		
C13 ,14		*	CE04EW1H101M	ELECTRO 100UF 50WV		
C15			CK45F1H223Z	CERAMIC 0.022UF Z		
C16			CC45SL2H121J	CERAMIC 120PF J		
C18			CK45B1H102K	CERAMIC 1000PF K		
C19			CK45F1H223Z	CERAMIC 0.022UF Z		
C20			CE04EW1H100M	ELECTRO 10UF 50WV		
C21			CM93D2H102J	MICA 1000PF J		
C22			C91-0119-05	CERAMIC 0.047UF K		
C23 ,24			CC45SL2H221J	CERAMIC 220PF J		
C25 -30		*	CK45B2H103K	CERAMIC 0.010UF K		
C31			CK45B1H102K	CERAMIC 1000PF K		
C33			CK45B1H222K	CERAMIC 2200PF K		
C34		*	CK45B2H103K	CERAMIC 0.010UF K		
C35		*	C90-2121-05	ELECTRO 2200UF 80WV		
C36			CE04EW1E471M	ELECTRO 470UF 25WV		
C37			CK45F1H223Z	CERAMIC 0.022UF Z		
C38 ,39			C91-1004-05	CHIP C 0.0068UF J		
CN1			E40-0470-05	PIN CONNECTOR(4P)		
CN2			E40-0370-05	PIN CONNECTOR(3P)		
CN3			E40-3239-05	PIN CONNECTOR(4P)		

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CN4			E40-3238-05	PIN CONNECTOR(3P)		
CN5			E40-3237-05	PIN CONNECTOR(2P)		
CN6			E04-0154-05	RF COAXIAL JACK		
TP1 ,2			E40-0211-05	PIN CONNECTOR		
W1		*	E31-6038-05	CONNECTING WIRE		
201	3K		F01-0969-21	HEAT SINK		
202	2J		F29-0014-05	INSULATOR		
F1	1J		F05-1031-05	FUSE(10A)		
203	1J,2J		G02-0571-04	FLAT SPRING		
			J13-0055-05	FUSE HOLDER		
L1			L40-1001-14	SMALL FIXED INDUCTOR(10UH)		
L2			L19-0315-25	BALUN TRANSFORMER		
L3		*	L39-0476-05	TROIDAL COIL		
L4		*	L39-0477-05	TROIDAL COIL		
L5		*	L39-0466-15	TROIDAL COIL		
L6 -8			L33-0617-05	RFC		
L9			L33-0699-05	CHOKE COIL		
L10			L40-3391-14	SMALL FIXED INDUCTOR(3.3UH)		
L11			L33-0699-05	CHOKE COIL		
L12 ,13		*	L33-0726-05	CHOKE COIL		
L14			L33-0699-05	CHOKE COIL		
L15 -17			L33-0699-05	CHOKE COIL		
L18 -21			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L22 ,23			L33-0651-05	CHOKE COIL		
205	2K		N15-1040-46	FLAT WASHER		
T	2J,2K		N30-3008-46	PAN HEAD MACHINE SCREW		
U	2J		N30-3010-46	PAN HEAD MACHINE SCREW		
V	2J		N35-3012-46	BINDING HEAD MACHINE SCREW		
W	2J,2K		N87-3008-46	BRAZIER HEAD TAPTITE SCREW		
R2			RD14BB2C560J	RD 56 J 1/6W		
R3			RD14BB2C681J	RD 680 J 1/6W		
R4			RD14BB2C221J	RD 220 J 1/6W		
R5			RC05GF2H3R9J	RC 3.9 J 1/2W		
R6			RD14CB2C331J	RD 330 J 1/6W		
R8 ,9			RD14CB2E150J	RD 15 J 1/4W		
R10 ,11			RC05GF2H181J	RC 180 J 1/2W		
R13 -16			RC05GF2H2R2J	RC 2.2 J 1/2W		
R17 ,18		*	RC05GF2H270J	RC 27 J 1/2W		
R19 ,20			RC05GF2H5R6J	RC 5.6 J 1/2W		
R21			RD14BB2C681J	RD 680 J 1/6W		
R22			RD14BB2C561J	RD 560 J 1/6W		
R23		*	RS14DB3A390J	FL-PROOF RS 39 J 1W		
R24			RD14BB2C273J	RD 27K J 1/6W		
R25			RD14BB2C104J	RD 100K J 1/6W		
R26 ,27			RS14DB3D121J	FL-PROOF RS 120 J 2W		
R28			RD14BB2C473J	RD 47K J 1/6W		
R29			RD14BB2C474J	RD 470K J 1/6W		
R30 ,31			RD14BB2C473J	RD 47K J 1/6W		
R32			RD14BB2C223J	RD 22K J 1/6W		
R33			RS14DB3A562J	FL-PROOF RS 5.6K J 1W		
R34			RD14BB2C152J	RD 1.5K J 1/6W		
R35			RD14BB2C123J	RD 12K J 1/6W		
R36			RS14DB3A560J	FL-PROOF RS 56 J 1W		

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R37		*	R92-1251-05	FIXED RESISTOR 0.1 OHM		
R38		*	R92-1247-05	FIXED RESISTOR 0.1 OHM		
VR1 -3			R12-1083-05	TRIMMING POT. 1K		
W2			R92-0150-05	JUMPER REST 0 OHM		
S1		*	S59-1413-05	THERMAL SWITCH(50°C)		
S2		*	S59-1414-05	THERMAL SWITCH(70°C)		
S3		*	S59-1415-05	THERMAL SWITCH(90°C)		
T1 -3			L92-0102-05	TROIDAL CORE(KT-41)		
D1			MV-5T	DIODE		
D2 ,3			SV03YS	DIODE		
D4			MTZ4.7JC	ZENER DIODE(4.7V)		
D5 ,6			1S1555	DIODE		
D7			MC921	DIODE		
D8			MTZ8.2JC	ZENER DIODE(8.2V)		
D9			1S1555	DIODE		
D10		*	UZP4.7B	ZENER DIODE(4.7V)		
Q1			2SC1971	TRANSISTOR		
Q2 ,3		*	2SC3133	TRANSISTOR		
Q4		*	MRF429MP	TRANSISTOR		
Q6 ,7			2SD1406(Y)	TRANSISTOR		
Q8		*	2SC2922	TRANSISTOR		
Q9			2SB861(C)	TRANSISTOR		
Q10			2SC2459(BL)	TRANSISTOR		
Q11			DTC124ES	DIGITAL TRANSISTOR		
Q12			DTC143TS	DIGITAL TRANSISTOR		
Q13			2SA562(Y)	TRANSISTOR		
Q14			DTC124ES	DIGITAL TRANSISTOR		
Q15			DTA124ES	DIGITAL TRANSISTOR		
DIGITAL UNIT (X46-3050-XX) -11 : K,P -21 : M -61 : W -62 : W2 -71 : X						
C1 ,2			CK73FB1H102K	CHIP C 1000PF K		
C3			CK73FB1E103K	CHIP C 0.010UF K		
C4 ,5			CK73FB1H102K	CHIP C 1000PF K		
C6			CK73FB1E103K	CHIP C 0.010UF K		
C7 -10			CK73FB1H102K	CHIP C 1000PF K		
C11 ,12			CK73FB1E103K	CHIP C 0.010UF K		
C13			CE04EW1C470M	ELECTRO 47UF 16WV		
C14 -16			CK73FB1E103K	CHIP C 0.010UF K		
C17			CE04EW1C470M	ELECTRO 47UF 16WV		
C18			CE04EW1H3R3M	ELECTRO 3.3UF 50WV		
C19 -25			CK73FB1E103K	CHIP C 0.010UF K		
C26			CE04EW1C470M	ELECTRO 47UF 16WV		
C27 ,28			CK73FB1H471K	CHIP C 470PF K		
C29			CE04EW1C470M	ELECTRO 47UF 16WV		
C30 -41			CK73FB1E103K	CHIP C 0.010UF K		
C42 -44			CK73FB1H102K	CHIP C 1000PF K		
C45 51			CK73FB1E103K	CHIP C 0.010UF K		
C52			CK73FF1E104Z	CHIP C 0.10UF Z		
C53 ,54			CC73FCH1H100D	CHIP C 10PF D		
C55 -72			CK73FB1E103K	CHIP C 0.010UF K		
C73			CE04EW1C470M	ELECTRO 47UF 16WV		
C74			CK73FF1E104Z	CHIP C 0.10UF Z		
C75			CE04EW1C101M	ELECTRO 100UF 16WV		
C76			CK73FF1E104Z	CHIP C 0.10UF Z		
C77			CK73FB1E103K	CHIP C 0.010UF K		

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Ref No. 参照番号	Address 位置	New Parts 新	Parts No 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
C78			CE04EW1C470M	ELECTRO 47UF 16WV		
C79			CK73FB1E103K	CHIP C 0.010UF K		
C80			CK73FF1E104Z	CHIP C 0.10UF Z		
C81			CE04EW1C470M	ELECTRO 47UF 16WV		
C82			C90-2041-05	ELECTRO 10UF 10WV		
C83			CK73FF1E104Z	CHIP C 0.10UF Z		
C84 99			CK73FB1E103K	CHIP C 0.010UF K		
C100			CE04EW1C470M	ELECTRO 47UF 16WV		
C101			CK73FF1E104Z	CHIP C 0.10UF Z		
C102			CK73FB1E103K	CHIP C 0.010UF K		
C103			CK73FF1E104Z	CHIP C 0.10UF Z		
C104-106			CK73FB1E103K	CHIP C 0.010UF K		
C107-120			CK73FB1H102K	CHIP C 1000PF K		
C121-142			CK73FB1E103K	CHIP C 0.010UF K		
C143,144			CE04EW1E220M	ELECTRO 22UF 25WV		
C145-170			CK73FB1EXXXK	CHIP C		
C171			CK73FF1E104Z	CHIP C 0.10UF Z		
C172-182			CK73FB1E103K	CHIP C 0.010UF K		
C183-188			CK73FB1H102K	CHIP C 1000PF K		
C189			CK73FF1E104Z	CHIP C 0.10UF Z		
C190			CK73FB1E103K	CHIP C 0.010UF K		
C191-205			CK73FB1H471K	CHIP C 470PF K		
C206,207			CK73FB1E103K	CHIP C 0.010UF K		
C208-216			CK73FB1H471K	CHIP C 470PF K		
C217			C91-0119-05	SR 0.047UF		
CN1			E40-5131-05	FPC CONNECTOR(16P)		
CN2		*	E40-5334-05	FPC CONNECTOR(24P)		
CN3		*	E40-5333-05	FPC CONNECTOR(14P)		
CN4			E40-5135-05	FPC CONNECTOR(20P)		
CN5			E40-5034-05	PIN CONNECTOR(10P)		
CN6		*	E40-5333-05	FPC CONNECTOR(14P)		
CN7			E40-3239-05	PIN CONNECTOR(4P)		
CN8			E40-3241-05	PIN CONNECTOR(6P)		
CN9			E40-3242-05	PIN CONNECTOR(7P)		
CN10			E40-3240-05	PIN CONNECTOR(5P)		
CN11			E40-3243-05	PIN CONNECTOR(8P)		
CN12			E40-3238-05	PIN CONNECTOR(3P)		
CN13			E40-3240-05	PIN CONNECTOR(5P)		
CN14			E40-3241-05	PIN CONNECTOR(6P)		
CN15			E40-3239-05	PIN CONNECTOR(4P)		
CN16			E40-3237-05	PIN CONNECTOR(2P)		
CN17			E40-3241-05	PIN CONNECTOR(6P)		
CN18			E40-3240-05	PIN CONNECTOR(5P)		
CN19			E40-3239-05	PIN CONNECTOR(4P)		
CN20			E40-3237-05	PIN CONNECTOR(2P)		
CN21			E40-3238-05	PIN CONNECTOR(3P)		
CN22			E40-3239-05	PIN CONNECTOR(4P)		
CN23			E40-3242-05	PIN CONNECTOR(7P)		
CN24		*	E02-2009-05	IC SOCKET(28P)		
L1 ,2			L40-1011-13	SMALL FIXED INDUCTOR(100UH)		
L3 ,4			L40-4701-17	SMALL FIXED INDUCTOR(47UH)		
L5			L40-1011-17	SMALL FIXED INDUCTOR(100UH)		
L6 -10			L40-1011-13	SMALL FIXED INDUCTOR(100UH)		
L11 ,12			L40-2211-17	SMALL FIXED INDUCTOR(220UH)		

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L13 ,14			L40-1011-13	SMALL FIXED INDUCTOR(100μH)		
L15 -18			L40-1011-13	SMALL FIXED INDUCTOR(100μH)		
X1			L77-1380-05	CRYSTAL RESONATOR(11.0592MHZ)		
CP1			R90-0455-05	MULTI COMP 4.7K×8 J 1/4W		
CP2 -5			R90-0598-05	MULTI-COMP 10K/20K		
CP6 -9		*	R90-0712-05	MULTI-COMP 330P K6		
R1 -169			RK73FB2AXXXJ	CHIP R		
VR1			R12-1084-05	TRIMMING POT. 1K		
VR2 -5			R12-1093-05	TRIMMING POT. 4.7K		
RW1 -3			R92-0150-05	JUMPER REST 0 OHM		
S1		*	S59-6403-05	SWITCH(FILTER SELECT)		
D1 -5			RLS73	CHIP DIODE		
D6 ,7			IMN10	CHIP DIODE		
D8 -11		*	02CZ5.1	CHIP ZENER DIODE 5.1V)		
D12			1SS133	DIODE	MX	
D14			1SS133	DIODE	W2	
D15			1SS133	DIODE	W	
D17			1SS133	DIODE	KMWW2	
D18 ,19			1SS133	DIODE		
D20			RLS73	CHIP DIODE		
D21			RLS73	CHIP DIODE	X	
IC1			UPD78C10G 36	IC(MICROPROCESSOR)		
IC2		*	27C256A-25JAW3	IC(ROM)		
IC3			TC5564APL-15	IC(8KX8 RAM)		
IC4		*	TC74HC573AF	IC(LATCH)		
IC5		*	TC74HC138AF	IC(DECODER)		
IC6		*	CXD1095Q	IC(I/O)		
IC7			MB89363B	IC(MICROPROCESSOR)		
IC8		*	CXD1095Q	IC(I/O)		
IC9 ,10			LZ92K37	IC(COUNTER)		
IC11			NJM4558M	IC(OP AMP X2)		
IC12		*	TC4584BF	IC(INVERTER)		
IC13		*	MB4056	IC(A/D CONV.)		
IC14			M51951BML	IC(SYSTEM RESET)		
IC15			SN7404N	IC(6-CIRCUIT INVERTER)		
IC16		*	NJM2902M	IC(OP AMP X4)		
IC17,18			TC4SU69F	IC(INVERTER GATE)		
IC19-21			TC4S81F	IC(AND GATE)		
Q1 -11		*	FMG1	DIGITAL TRANSISTOR		
BA1			W09-0514-05	LITHUM BATTERY		

IF UNIT (X48-3060-00)

Ref No	Address	New Parts	Parts No.	Description	Destination	Remarks
C1			CK73FB1H222K	CHIP C 2200PF K		
C2			CK73FF1E104Z	CHIP C 0.10UF Z		
C3 -5			CK73FB1HXXXK	CHIP C		
C6 -11			CK73FB1EXXXK	CHIP C		
C12			CK73FB1H222K	CHIP C 2200PF K		
C13			CK73FB1E103K	CHIP C 0.010UF K		
C14			CC73FCH1H100D	CHIP C 10PF D		
C15 -19			CK73FB1E103K	CHIP C 0.010UF K		
C20			CC73FCH1H101J	CHIP C 100PF J		
C21 -23			CK73FB1E103K	CHIP C 0.010UF K		
C24			CK73FF1E104Z	CHIP C 0.10UF Z		

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C25			CE04EW1C470M	ELECTRO	47UF 16WV		
C26			CK73FB1E223K	CHIP C	0.022UF K		
C27			CK73EF1E474Z	CHIP C	0.47UF Z		
C28			CE04EW1C100M	ELECTRO	10UF 16WV		
C29			CK73FB1H102K	CHIP C	1000PF K		
C30			CC73FSL1H221J	CHIP C	220PF J		
C31			CK73FB1E103K	CHIP C	0.010UF K		
C32			CE04EW1C100M	ELECTRO	10UF 16WV		
C33			CE04EW1H3R3M	ELECTRO	3.3UF 50WV		
C34 39			CK73FB1HXXXK	CHIP C			
C40 -43			CC73FCH1HXXXC	CHIP C			
C44			CK73FB1H102K	CHIP C	1000PF K		
C45			CK73FF1E104Z	CHIP C	0.10UF Z		
C46 -48			CK73FB1H102K	CHIP C	1000PF K		
C49 ,50			CK73FB1E103K	CHIP C	0.010UF K		
C51			CK73FB1H102K	CHIP C	1000PF K		
C52			CK73FB1E103K	CHIP C	0.010UF K		
C53 ,54			CC73FCH1H220J	CHIP C	22PF J		
C55			CK73FB1E103K	CHIP C	0.010UF K		
C56			CC73FCH1H101J	CHIP C	100PF J		
C57 ,58			CK73FB1E103K	CHIP C	0.010UF K		
C59			CC73FCH1H470J	CHIP C	47PF J		
C60			CK73FB1E223K	CHIP C	0.022UF K		
C61			CC73FSL1H221J	CHIP C	220PF J		
C62			CC73FCH1H470J	CHIP C	47PF J		
C63 ,64			CK73FB1E223K	CHIP C	0.022UF K		
C65 66			CC73FCH1HXXXJ	CHIP C			
C67 -71			CK73FB1H102K	CHIP C	1000PF K		
C72			CC73FCH1H470J	CHIP C	47PF J		
C73			CK73FB1E103K	CHIP C	0.010UF K		
C74			CK73FB1H102K	CHIP C	1000PF K		
C75			CK73FF1E473Z	CHIP C	0.047UF Z		
C76			CK73FB1E103K	CHIP C	0.010UF K		
C77			CE04EW1H010M	ELECTRO	1.0UF 50WV		
C78 82			CK73FB1E103K	CHIP C	0.010UF K		
C83			CK73FB1H102K	CHIP C	1000PF K		
C84 ,85			CK73FF1E104Z	CHIP C	0.10UF Z		
C86 ,87			CK73FB1E103K	CHIP C	0.010UF K		
C88 -90			CK73FB1H102K	CHIP C	1000PF K		
C91			CK73FF1E104Z	CHIP C	0.10UF Z		
C92 -99			CK73FB1E103K	CHIP C	0.010UF K		
C100			CC73FCH1H020C	CHIP C	2.0PF C		
C101-104			CK73FB1EXXXK	CHIP C			
C105			CK73FB1H102K	CHIP C	1000PF K		
C106-110			CK73FF1E104Z	CHIP C	0.10UF Z		
C111			CC73FCH1H330J	CHIP C	33PF J		
C112			CK73EF1E474Z	CHIP C	0.47UF Z		
C113-130			CK73FB1E103K	CHIP C	0.010UF K		
C131,132			CK73FF1E473Z	CHIP C	0.047UF Z		
C133			CC73FCH1H101J	CHIP C	100PF J		
C134			CK73FF1E473Z	CHIP C	0.047UF Z		
C135-141			CK73FB1E103K	CHIP C	0.010UF K		
C142			CC73FCH1H101J	CHIP C	100PF J		
C143-147			CK73FB1H102K	CHIP C	1000PF K		
C148			CK73FB1E103K	CHIP C	0.010UF K		

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C149			CK45E2H222P	CERAMIC 2200PF P		
C150-152			CK73FB1H102K	CHIP C .001UF K		
C153			CC73FCH1H101J	CHIP C 100PF J		
C154,155			CK73FF1E104Z	CHIP C 0.10UF Z		
C156			CC73FCH1H101J	CHIP C 100PF J		
C157			CE04EW1A101M	ELECTRO 100UH 10WV		
C158			CK73FF1E104Z	CHIP C 0.10UF Z		
C159			CE04EW1C100M	ELECTRO 10UF 16WV		
C161			CK73EF1C105Z	CHIP C 1.0UF Z		
C162			CK73FB1E103K	CHIP C 0.01UF K		
C163 165			CK73FB1H102K	CHIP C 1000PF K		
C166			CC73FCH1H220J	CHIP C 22PF J		
C167-175			CK73FB1HXXXZ	CHIP C		
C176,177			CC73FCH1H220J	CHIP C 22PF J		
C178			CC73FSL1H221J	CHIP C 220PF J		
CN1			E40-5067-05	PIN CONNECTOR(10P)		
CN2			E40-3237-05	PIN CONNECTOR(2P)		
CN3			E40-3238-05	PIN CONNECTOR(3P)		
CN4 7			E04-0157-05	RF COAXIAL JACK		
CN8			E40-3237-05	PIN CONNECTOR(2P)		
CN9			E04-0154-05	RF COAXIAL JACK		
CN10			E40-3237-05	PIN CONNECTOR(2P)		
CN11			E40-3239-05	PIN CONNECTOR(4P)		
CN12			E23-0401-05	TERMINAL(1P)		
CN13			E40-3237-05	PIN CONNECTOR(2P)		
CN14			E40-5066-05	PIN CONNECTOR(9P)		
CN15			E40-3243-05	PIN CONNECTOR(8P)		
CN16			E40-3238-05	PIN CONNECTOR(3P)		
CN17			E40-3237-05	PIN CONNECTOR(2P)		
CN18			E40-3238-05	PIN CONNECTOR(3P)		
CN19-24			E40-5059-05	PIN CONNECTOR(XTAL FILTER)		
J1		*	E11-0438-05	PHONE JACK(KEY)		
J2			E11-0414-05	PHONE JACK(EXT.SP)		
J3			E06-1352-05	DIN SOCKET(ACC2)		
J4			E13-0462-05	PHONO JACK(RCA 4P)		
J5			E06-0752-05	DIN CONNECTOR(REMOTE 7P)		
TP1 -3			E23-0512-05	TERMINAL		
			J32-0761-04	STUD		
CF1			L72-0351-05	CERAMIC FILTER(8.83MHZ)		
L1			L34-2267-05	TUNING COIL		
L2		*	L34-4205-05	TUNING COIL		
L3			L34-4025-05	TUNING COIL		
L4 -7			L30-0281-15	IFT		
L8		*	L34-4206-05	TUNING COIL		
L9 -11			L34-4006-05	TUNING COIL		
L12		*	L34-4209-05	TUNING COIL		
L13			L34-0943-05	TUNING COIL		
L14 ,15			L34-0942-05	TUNING COIL		
L16			L34-0943-05	TUNING COIL		
L17			L34-2124-05	TUNING COIL		
L18			L34-0536-05	TUNING COIL		
L19			L34-0781-05	TUNING COIL		
L20		*	L34-4210-05	TUNING COIL		

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L21 ,22			L30-0281-15	IFT		
L23		*	L34 4190 05	TUNING COIL		
L24		*	L34-4207-05	TUNING COIL		
L25			L34-0943-05	TUNING COIL		
L26			L34 0781-05	TUNING COIL		
L27 -29			L34-0536-05	TUNING COIL		
L30			L34-0781-05	TUNING COIL		
L31			L34-0536-05	TUNING COIL		
L32 -35			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L36			L40-2292-14	SMALL FIXED INDUCTOR(2.2UH)		
L37 -39			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L41			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L42			L40-1801-14	SMALL FIXED INDUCTOR(18UH)		
L43			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
XF1			L71-0249-05	CRYSTAL FILTER(10.695MHZ)		
XF2		*	L71-0401-05	MCF(73.05MHZ)		
XF3			L71-0222-05	CRYSTAL FILTER(8.83MHZ)		
J	3F		N30-3010-46	PAN HEAD MACHINE SCREW		
114			RK73FB2AXXXJ	CHIP R		
R115			RD14BB2C103J	RD 10K J 1/6W		
R116-234			RK73FB2AXXXJ	CHIP R		
R235			RD14BB2C103J	RD R 10K J 1/10W		
VR1			R12-0104 -05	TRIMMING POT. 220		
VR2 ,3			R12-3126-05	TRIMMING POT. 10K		
VR4			R12-0108-05	TRIMMING POT. 470		
VR5			R12-3126-05	TRIMMING POT. 10K		
K1			S51-1420-05	RELAY		
SW1 ,2		*	S31-2419-05	SLIDE SWITCH		
D1 ,2			DAN202(K)	CHIP DIODE		
D3			HSM88AS	CHIP DIODE		
D4			DLS1585	CHIP DIODE		
D5 -8			RLS135	CHIP DIODE		
D9		*	RLZ6.2A	CHIP ZENER DIODE(6.2V)		
D10			RLS135	CHIP DIODE		
D11			DAN202(K)	CHIP DIODE		
D12 -29			RLS135	CHIP DIODE		
D30			DAN202(K)	CHIP DIODE		
D31			RLS135	CHIP DIODE		
D32 ,33			HSM88AS	CHIP DIODE		
D34			DLS1585	CHIP DIODE		
D35			LT8001P	LED		
D36			DLS1585	CHIP DIODE		
D37 -39			RLS135	CHIP DIODE		
D40			DLS1585	DIODE		
D41 ,42			1S1555	DIODE		
D43			DLS1585	CHIP DIODE		
IC1			AN612	IC(BALANCE MODULATOR)		
Q1			3SK131(M)	CHIP FET		
Q2 ,3		*	2SK520(K44)	CHIP FET		
Q4			DTC124EK	DIGITAL TRANSISTOR		
Q5			3SK131(M)	CHIP FET		
Q6 -8			2SC2712(Y)	CHIP TRANSISTOR		
Q9 ,10			3SK131(M)	CHIP FET		

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Q11			2SC2714(Y)	CHIP TRANSISTOR		
Q12			2SC2712(Y)	CHIP TRANSISTOR		
Q13			2SC2714(Y)	CHIP TRANSISTOR		
Q14			3SK131(M)	CHIP FET		
Q15 ,16			2SK520(K44)	CHIP FET		
Q17			2SC2712(Y)	CHIP TRANSISTOR		
Q18			2SA1162(Y)	CHIP TRANSISTOR		
Q19 ,20			3SK131(M)	CHIP FET		
Q21 ,22			2SC2712(Y)	CHIP TRANSISTOR		
Q23			2SC2714(Y)	CHIP TRANSISTOR		
Q24			3SK131(M)	CHIP FET		
Q25			2SC2714(Y)	CHIP TRANSISTOR		
Q26			2SK210(GR)	CHIP FET		
Q27 -29			2SC2714(Y)	CHIP TRANSISTOR		
Q30			2SC2712(Y)	CHIP TRANSISTOR		
Q31			2SC2714(Y)	CHIP TRANSISTOR		
Q32 ,33			2SC2712(Y)	CHIP TRANSISTOR		
Q34			DTA124EK	DIGITAL TRANSISTOR		
Q35			2SA1162(Y)	CHIP TRANSISTOR		
Q36 -38			3SK131(M)	CHIP FET		
Q39			2SC2714(Y)	CHIP TRANSISTOR		
Q40			2SC2712(Y)	CHIP TRANSISTOR		
Q41			3SK131(M)	CHIP FET		
Q42			2SC3324(G)	CHIP TRANSISTOR		
Q44		*	2SK520(K44)	CHIP FET		
Q45			DTC124EK	DIGITAL TRANSISTOR		
TH1 ,2			112-502-2	THERMISTOR 5K		
TH3			112-501-2	THERMISTOR 500		
			X59-3350-00	MODULE UNIT(NE2)		
AF UNIT (X49-3020-00)						
C1			CK73FB1H472K	CHIP C 4700PF K		
C2 ,3			CK73FF1E104Z	CHIP C 0.10UF Z		
C4			CK73FB1E103K	CHIP C 0.010UF K		
C5 -10			CK73FF1E104Z	CHIP C 0.10UF Z		
C11			CE04EW1C470M	ELECTRO 47UF 16WV		
C12			CE04EW1H010M	ELECTRO 1.0UF 50WV		
C13			CE04EW1C470M	ELECTRO 47UF 16WV		
C14			CE04EW1H010M	ELECTRO 1.0UF 50WV		
C15 ,16			CK73EF1C105Z	CHIP C 1.0UF Z		
C17			CK73FB1H473K	CHIP C 0.047UF K		
C18			CK73FF1E104Z	CHIP C 0.1UF Z		
C19			CK73EF1C105Z	CHIP C 1.0UF Z		
C20			CE04EW1H010M	ELECTRO 1.0UF 50WV		
C21			CE04EW1C470M	ELECTRO 47UF 16WV		
C22			CE04EW1H010M	ELECTRO 1.0UF 50WV		
C23 ,24			CE04EW1C470M	ELECTRO 47UF 16WV		
C25			CE04EW1H010M	ELECTRO 1.0UF 50WV		
C26			CE04EW1E4R7M	ELECTRO 4.7UF 25WV		
C27			CK73EF1C105Z	CHIP C 1.0UF Z		
C28			CE04EW1E4R7M	ELECTRO 4.7UF 25WV		
C29			CK73EF1C105Z	CHIP C 1.0UF Z		
C30			CK73FB1H102K	CHIP C 1000PF K		
C31			CE04EW1C470M	ELECTRO 47UF 16WV		
C32 -34			CE04EW1C100M	ELECTRO 10UF 16WV		

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C35			CK73FB1E103K	CHIP C	0.010UF	K		
C36			CE04EW1C1CCM	ELECTRO	100UF	16WV		
C37			CE04EW1C470M	ELECTRO	47UF	16WV		
C38 ,39			CE04EW1C100M	ELECTRO	10UF	16WV		
C40			CK73FB1E103K	CHIP C	0.010UF	K		
C41 ,42			CE04EW1H0R1M	ELECTRO	0.1UF	50WV		
C43			CE04EW1C470M	ELECTRO	47UF	16WV		
C44			CK73FB1E103K	CHIP C	0.010UF	K		
C45			CE04EW1E4R7M	ELECTRO	4.7UF	25WV		
C46			CE04EW1H010M	ELECTRO	1.0UF	50WV		
C47			CK73FF1E104Z	CHIP C	0.1UF	Z		
C48			CK73FB1H472K	CHIP C	4700PF	K		
C49			CE04EW1E4R7M	ELECTRO	4.7UF	25WV		
C50			CE04EW1C470M	ELECTRO	47UF	16WV		
C51 ,52			CE04EW1C100M	ELECTRO	10UF	16WV		
C53			CK73FF1E104Z	CHIP C	0.10UF	Z		
C54			CE04EW1C470M	ELECTRO	47UF	16WV		
C55			CE04EW1C100M	ELECTRO	10UF	16WV		
C56			CK73FB1H102K	CHIP C	1000PF	K		
C57			CE04EW1C470M	ELECTRO	47UF	16WV		
C58 -60			CK73FB1HXXXK	CHIP C				
C61 ,62			CE04EW1C470M	ELECTRO	47UF	16WV		
C63			CE04EW1C100M	ELECTRO	10UF	16WV		
C64 ,65			CE04EW1C470M	ELECTRO	47UF	16WV		
C66			CK73EB1H102K	CHIP C	1000PF	K		
C67 ,68			CK73EF1C105Z	CHIP C	1.0UF	Z		
C69			CK73FB1E123K	CHIP C	0.012UF	K		
C70			CK73FF1E104Z	CHIP C	0.10UF	Z		
C71 ,72			CK73FB1E103K	CHIP C	0.010UF	K		
C73 ,74			CK73FF1E104Z	CHIP C	0.10UF	Z		
C77 -80			CC73FSL1H101J	CHIP C	100PF	J		
C81			CK73FB1H102K	CHIP C	1000PF	K		
C82			CK73FF1E104Z	CHIP C	0.10UF	Z		
C83			CE04EW1C221M	ELECTRO	220UF	16WV		
C84			CE04EW1C471M	ELECTRO	470UF	16WV		
C85 -88			CK73FB1H102K	CHIP C	1000PF	K		
C89			CQ92M1H103K	MYLAR	0.010UF	K		
C90			C91-1083-05	FILM	0.47UF	63WV		
C91			CK73FF1E104Z	CHIP C	0.10UF	Z		
C92			CE04EW1C101M	ELECTRO	100UF	16WV		
C93 -97			CK73FB1E103K	CHIP C	0.010UF	K		
C98 -100			CK73FB1H102K	CHIP C	1000PF	K		
C101-103			CC73FCH1HXXXC	CHIP C				
C104-106			CK73FB1H102K	CHIP C	1000PF	K		
C107,108			CK73FB1E103K	CHIP C	0.010UF	K		
C109			CK73FB1H102K	CHIP C	1000PF	K		
C110			CK73FB1E103K	CHIP C	0.010UF	K		
C111			CE04EW1C470M	ELECTRO	47UF	16WV		
C112-117			CK73FB1E103K	CHIP C	0.010UF	K		
C118-127			CC73FCH1HXXXJ	CHIP C				
C128 130			CK73FB1E103K	CHIP C	0.010UF	K		
C131 133			CK73FB1H102K	CHIP C	1000PF	K		
C134			CK73FF1E104Z	CHIP C	0.10UF	Z		
C135			CE04EW1C470M	ELECTRO	47UF	16WV		
C136			CK73FB1E103K	CHIP C	0.010UF	K		

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C137			CK73FB1H102K	CHIP C 1000PF K		
C138			CK73FB1E103K	CHIP C 0.010UF K		
C139			CK73FB1H102K	CHIP C 1000PF K		
C140			CK73FB1E103K	CHIP C 0.010UF K		
C141			CE04EW1C470M	ELECTRO 47UF 16WV		
C142,143			CK73FB1E103K	CHIP C 0.010UF K		
C144			CQ92M1H333K	MYLAR 0.033UF K		
C145			CE04EW1C470M	ELECTRO 47UF 16WV		
C146			C91-1101-05	FILM 0.22UF 63WV		
C147			CS15E1VR47M	TANTAL 0.47UF 35WV		
C148			CK45B1H102K	CHIP C 1000PF K		
C149			CK73FF1E104Z	CHIP C 0.10UF Z		
C150			CE04EW1C101M	ELECTRO 100UF 16WV		
C151-153			CK73FB1H102K	CHIP C 1000PF K		
C154-156			CC73FCH1HXXXJ	CHIP C		
C157			CK73FB1H102K	CHIP C 1000PF K		
C158			CK73FF1E104Z	CHIP C 0.10UF Z		
C159			CE04EW1C470M	ELECTRO 47UF 16WV		
C160			CK73FF1E104Z	CHIP C 0.10UF Z		
C161			CE04EW1C470M	ELECTRO 47UF 16WV		
C162			CK73FF1E104Z	CHIP C 0.10UF Z		
C163			CE04EW1C470M	ELECTRO 47UF 16WV		
C164			CC73FCH1H470J	CHIP C 47PF J		
C165,166			CK73FF1E473Z	CHIP C 0.047UF Z		
C167			CE04EW1C470M	ELECTRO 47UF 16WV		
C168			CK73FB1H102K	CHIP C 1000PF K		
C169			CE04EW1HR47M	ELECTRO 0.47UF 50WV		
C170			CE04EW1H010M	ELECTRO 1.0UF 50WV		
C171,172			CK73FF1E104Z	CHIP C 0.10UF Z		
C173			CK73FB1E103K	CHIP C 0.010UF K		
C174			CK73FF1E473Z	CHIP C 0.047UF Z		
C175			CK73FB1E103K	CHIP C 0.010UF K		
C176			CK73FB1H102K	CHIP C 1000PF K		
C177			CK73FF1E104Z	CHIP C 0.10UF Z		
C178			CK73FB1H102K	CHIP C 1000PF		
C179			CC73FSL1H331J	CHIP C 330PF J		
C180			CK73FB1H102K	CHIP C 1000PF K		
C181			CC73FSL1H331J	CHIP C 330PF J		
C182			CK73FF1E104Z	CHIP C 0.10UF Z		
C183			CK73FB1H102K	CHIP C 1000PF K		
C184,185			CK73FF1E104Z	CHIP C 0.10UF Z		
C186,187			CK73FB1H102K	CHIP C 1000PF K		
C188			CC73FSL1H151J	CHIP C 150PF J		
C189			CE04EW1E4R7M	ELECTRO 4.7UF 25WV		
CN1			E40-5038-05	FPC CONNECTOR(14P)		
CN2			E40-3237-05	PIN CONNECTOR(2P)		
CN3			E40-3241-05	PIN CONNECTOR(6P)		
CN4 ,5			E40-3239-05	PIN CONNECTOR(4P)		
CN6			E40-3237-05	PIN CONNECTOR(2P)		
CN7			E40-3240-05	PIN CONNECTOR(5P)		
CN8			E40-3243-05	PIN CONNECTOR(8P)		
CN9			E40-3237-05	PIN CONNECTOR(2P)		
CN10			E40-3239-05	PIN CONNECTOR(4P)		
CN11			E40-3238-05	PIN CONNECTOR(3P)		

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CN12			E40-3240-05	PIN CONNECTOR(5P)		
CN13,14			E40-3239-05	PIN CONNECTOR(4P)		
CN15			E40-3237-05	PIN CONNECTOR(2P)		
CN16			E40-5038-05	FPC CONNECTOR(14P)		
CN17			E40-3240-05	PIN CONNECTOR(5P)		
CN18			E40-3237-05	PIN CONNECTOR(2P)		
CN19,20			E04-0154-05	RF COAXIAL JACK		
CN21			E23-0401-05	TERMINAL		
TP1,2			E23-0464-05	TERMINAL		
L1,2			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L3			L40-3982-17	SMALL FIXED INDUCTOR(0.39UH)		
L4			L40-1292-17	SMALL FIXED INDUCTOR(1.2UH)		
L5			L40-3982-17	SMALL FIXED INDUCTOR(0.39UH)		
L6			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L7			L40-1092-17	SMALL FIXED INDUCTOR(1UH)		
L8			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L9		*	L40-8282-17	SMALL FIXED INDUCTOR(0.82UH)		
L10			L40-3982-17	SMALL FIXED INDUCTOR(0.39UH)		
L11			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L12			L34-1124-05	COIL (50,7T)		
L13			L34-0535-05	TUNING COIL		
L14			L34-0536-05	TUNING COIL		
R1 -207			RK73FB2AXXXJ	CHIP R		
VR1			R12-3126-05	TRIMMING POT. 10K		
VR2			R12-3128-05	TRIMMING POT. 22K		
VR3 -5			R12-3126-05	TRIMMING POT. 10K		
VR6			R12-3128-05	TRIMMING POT. 22K		
W3,4			R92-0150-05	JUMPER REST 0 OHM		
D1			DAN202(K)	CHIP DIODE		
D2			RLS73	CHIP DIODE		
D3			DAP202(K)	CHIP DIODE		
D4			RLS73	CHIP DIODE		
D5			DAP202(K)	CHIP DIODE		
D6			DAN202(K)	CHIP DIODE		
D7 -9			RLS73	CHIP DIODE		
D10			DAP202(K)	CHIP DIODE		
D11,12			DAN202(K)	CHIP DIODE		
D13			RLS73	CHIP DIODE		
D14			DAN202(K)	CHIP DIODE		
D15 17			RLS73	CHIP DIODE		
D19			DAP202(K)	CHIP DIODE		
D21			RLS73	CHIP DIODE		
D22,23			DAN202(K)	CHIP DIODE		
D24		*	RLZJ12B	CHIP ZENER DIODE(12V)		
D25,26			RLS73	CHIP DIODE		
D27		*	RLZJ9.1B	CHIP ZENER DIODE(9.1V)		
D28 -30			HSM88AS	CHIP DIODE		
D31 -33			RLS73	CHIP DIODE		
D34			1SS133	DIODE		
IC1		*	SN74LS390NS	IC(DIV 1/100)		
IC2		*	MF10CCWM	IC(SWITCHED CAPACITOR)		
IC3		*	MF5CWM	IC(SWITCHED CAPACITOR)		
IC4 -6			TC4066BF	IC(BILATERAL SWITCH X4)		

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IC7 ,8			NJM4558M	IC(OP AMP X2)		
IC9		*	TC4538BF	IC(ONE SHOT MULTI)		
IC10			TC4066BF	IC(BILATERAL SWITCH X4)		
IC11		*	CXD1225M	IC(PLL)		
IC12			SN76514N	IC(DIV 1/100)		
IC13		*	CXD1225M	IC(PLL)		
IC14		*	AN78N10	IC(10V AVR)		
IC15			AN78N05	IC(5V AVR)		
Q1			2SC2712(Y)	CHIP TRANSISTOR		
Q2			DTC124EK	DIGITAL TRANSISTOR		
Q3			DTA124EK	DIGITAL TRANSISTOR		
Q4			DTC124EK	DIGITAL TRANSISTOR		
Q5			DTA124EK	DIGITAL TRANSISTOR		
Q6			2SD1757(K)	CHIP TRANSISTOR		
Q7			2SC2712(Y)	CHIP TRANSISTOR		
Q8 ,9			2SD1757(K)	CHIP TRANSISTOR		
Q10 ,11			2SC2712(Y)	CHIP TRANSISTOR		
Q12			2SD1757(K)	CHIP TRANSISTOR		
Q13 ,14			DTA124EK	DIGITAL TRANSISTOR		
Q15			2SC2712(Y)	CHIP TRANSISTOR		
Q16			DTC144WK	DIGITAL TRANSISTOR		
Q17			DTC124EK	DIGITAL TRANSISTOR		
Q18 ,19			DTA124EK	DIGITAL TRANSISTOR		
Q20			2SC2712(Y)	CHIP TRANSISTOR		
Q21 -23			DTA124EK	DIGITAL TRANSISTOR		
Q24 -27			DTC114EK	DIGITAL TRANSISTOR		
Q28			DTC114TK	DIGITAL TRANSISTOR		
Q29 -31			2SC3324(G)	CHIP TRANSISTOR		
Q32 36			2SC2714(Y)	CHIP TRANSISTOR		
Q37			2SC2996(Y)	CHIP TRANSISTOR		
Q38			2SC2712(Y)	CHIP TRANSISTOR		
Q39			2SC2714(Y)	CHIP TRANSISTOR		
Q40			2SK210(GR)	CHIP FET		
Q41 -47			2SC2712(Y)	CHIP TRANSISTOR		
Q48			DTA124EK	DIGITAL TRANSISTOR		
Q49			2SA1162(Y)	CHIP TRANSISTOR		
Q50			DTC114EK	DIGITAL TRANSISTOR		
Q51			DTA124EK	DIGITAL TRANSISTOR		
Q52			DTC124EK	DIGITAL TRANSISTOR		
		*	X58-3390-03	SUB UNIT(VC02)		
		*	X58-3630-00	SUB UNIT(VC0)		
		*	X59-1080-01	MODULE UNIT(V&X)		
		*	X59-3000-03	MODULE UNIT(FM MIC)		
			X59-3350-00	MODULE UNIT(NB2)		
			X59-3450-00	MODULE UNIT(LPF)		

PLL UNIT (X50-3100-00)

C1			CE04EW1E470M	ELECTRO	47UF	25WV	
C2			CK73FF1E104Z	CHIP C	0.10UF	Z	
C3			CE04EW1C470M	ELECTRO	47UF	16WV	
C4			CK73FF1E104Z	CHIP C	0.10UF	Z	
C5			CE04EW1A470M	ELECTRO	47UF	10WV	
C6			CK73FF1E104Z	CHIP C	0.10UF	Z	
C7			CE04EW1C470M	ELECTRO	47UF	16WV	
C8			CK73FB1E103K	CHIP C	0.010UF	K	

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C9			CE04EW1A470M	ELECTRO	47UF	10WV		
C10			CK73FB1H102K	CHIP C	1000PF	K		
C11			CK73FB1E103K	CHIP C	0.010UF	K		
C12			CK73FB1H102K	CHIP C	1000PF	K		
C13			CE04EW1C470M	ELECTRO	47UF	16WV		
C14			CQ92M1H472K	MYLAR	4700PF	K		
C15			CQ92M1H223K	MYLAR	0.022UF	K		
C16			C91-0105-05	CHIP C	0.0047UF	K		
C17			CK73FB1E103K	CHIP C	0.010UF	K		
C18			CE04EW1C470M	ELECTRO	47UF	16WV		
C19			CC73FRH1H270J	CHIP C	27PF	J		
C20 ,21			CC73FCH1H330J	CHIP C	33PF	J		
C22 24			CK73FB1E103K	CHIP C	0.010UF	K		
C25			CE04EW1A470M	ELECTRO	47UF	10WV		
C26			CK73FB1E103K	CHIP C	0.010UF	K		
C27			CK73FF1E473Z	CHIP C	0.047UF	Z		
C28			CC73FCH1H680J	CHIP C	68PF	J		
C29			CC73FSL1H151J	CHIP C	150PF	J		
C30			CC73FCH1H680J	CHIP C	68PF	J		
C31 -35			CK73FF1E473Z	CHIP C	0.047UF	Z		
C36 -52			CK73FB1EXXXK	CHIP C				
C53			CE04EW1A470M	ELECTRO	47UF	10WV		
C54			CK73FB1H102K	CHIP C	1000PF	K		
C55			CK73FB1E103K	CHIP C	0.010UF	K		
C56			CK73FB1H102K	CHIP C	1000PF	K		
C57			CE04EW1C470M	ELECTRO	47UF	16WV		
C58			CQ92M1H103K	MYLAR	0.010UF	K		
C59			CQ92M1H473K	MYLAR	0.047UF	K		
C60			CK45B1H102K	CERAMIC	1000PF	K		
C61			CK73FB1E103K	CHIP C	0.010UF	K		
C62			CE04EW1C470M	ELECTRO	47UF	16WV		
C63			CC73FRH1H470J	CHIP C	47PF	J		
C64 ,65			CC73FCH1H330J	CHIP C	33PF	J		
C66 -68			CK73FB1E103K	CHIP C	0.010UF	K		
C69			CK73FF1E473Z	CHIP C	0.047UF	Z		
C70 -72			CC73FCH1HXXXJ	CHIP C				
C73 -77			CK73FF1E473Z	CHIP C	0.047UF	Z		
C78			CC73FCH1H150J	CHIP C	15PF	J		
C79 ,80			CK73FB1E103K	CHIP C	0.010UF	K		
C81			CC73FCH1H010C	CHIP C	1.0PF	C		
C82 -86			CK73FB1E103K	CHIP C	0.010UF	K		
C87			CC73FCH1H470J	CHIP C	47PF	J		
C88 ,89			CK73FB1E103K	CHIP C	0.010UF	K		
C90			CC73FCH1H470J	CHIP C	47PF	J		
C91			CC73FSL1H101J	CHIP C	100PF	J		
C92			CC73FCH1H470J	CHIP C	47PF	J		
C93			CK73FB1E103K	CHIP C	0.010UF	K		
C94 -96			CC73FCH1HXXXJ	CHIP C				
C97			CK73FB1E103K	CHIP C	0.010UF	K		
C98			CE04EW1A470M	ELECTRO	47UF	10WV		
C99			CK73FB1H102K	CHIP C	1000PF	K		
C100			CK73FB1E103K	CHIP C	0.010UF	K		
C101			CK73FB1H102K	CHIP C	1000PF	K		
C102			CE04EW1C470M	ELECTRO	47UF	16WV		
C103			CQ92M1H472K	MYLAR	4700PF	K		

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C104			CQ92M1H223K	MYLAR	0.022UF K		
C105			C91-0105-05	CERAMIC	0.0047UF K		
C106			CK73FB1H102K	CHIP C	1000PF K		
C107			CE04EW1C470M	ELECTRO	47UF 16WV		
C108			CC73FRH1H150J	CHIP C	15PF J		
C110			CC73FCH1H220J	CHIP C	22PF J		
C111,112			CK73FB1H102K	CHIP C	1000PF K		
C113			CK73FB1E103K	CHIP C	0.010UF K		
C114			CE04EW1A470M	ELECTRO	47UF 10WV		
C115			CK73FB1H102K	CHIP C	1000PF K		
C116			CK73FF1E473Z	CHIP C	0.047UF Z		
C117-119			CC73FCH1HXXXJ	CHIP C			
C120-124			CK73FF1E473Z	CHIP C	0.047UF Z		
C125-131			CK73FB1E103K	CHIP C	0.010UF K		
C132			CK73FF1E473Z	CHIP C	0.047UF Z		
C133			CC73FCH1H680J	CHIP C	68PF J		
C134			CC73FSL1H151J	CHIP C	150PF J		
C135			CC73FCH1H680J	CHIP C	68PF J		
C136-140			CK73FF1E473Z	CHIP C	0.047UF Z		
C141-162			CK73FB1EXXXK	CHIP C			
C163			CE04EW1C221M	ELECTRO	220UF 16WV		
C164			CE04EW1C331M	ELECTRO	330UF 16WV		
C165			CK73FB1E103K	CHIP C	0.010UF K		
C166-172			CC73FCH1HXXXD	CHIP C			
C173			CK73FB1E103K	CHIP C	0.010UF K		
C174,175			CK73FF1E473Z	CHIP C	0.047UF Z		
C176,177			CK73FB1E103K	CHIP C	0.010UF K		
C178			CE04EW1A470M	ELECTRO	47UF 10WV		
C179			CK73FB1H102K	CHIP C	1000PF K		
C180			CK73FB1E103K	CHIP C	0.010UF K		
C181			CK73FB1H102K	CHIP C	1000PF K		
C182			CK73FB1E103K	CHIP C	0.010UF K		
C183			CE04EW1C470M	ELECTRO	47UF 16WV		
C184			CE04EW1H010M	ELECTRO	1.0UF 50WV		
C185			CK73FB1E103K	CHIP C	0.010UF K		
C186			CQ92M1H223K	MYLAR	0.022UF K		
C187			C91-1083-05	FILM	0.47UF 63WV		
C188			CQ92M1H223K	MYLAR	0.022UF K		
C189			C91-1083-05	FILM	0.47UF 63WV		
C190-192			CK73FB1E103K	CHIP C	0.010UF K		
C193-195			CC73FCH1HXXXD	CHIP C			
C196-200			CK73FB1E103K	CHIP C	0.010UF K		
C201			CE04EW1C470M	ELECTRO	47UF 16WV		
C202			CK73FB1E103K	CHIP C	0.010UF K		
C203-204			CC73FCH1HXXXJ	CHIP C			
C205			CK73FB1H102K	CHIP C	1000PF K		
C206-207			CC73FCH1HXXXJ	CHIP C			
C208,209			CK73FB1E103K	CHIP C	0.010UF K		
C210-212			CC73FCH1HXXXJ	CHIP C			
C213-219			CK73FB1E103K	CHIP C	0.010UF K		
C220,221			CK73FB1H102K	CHIP C	1000PF K		
C222-225			CK73FB1E103K	CHIP C	0.010UF K		
C226-239			CC73FSL1H101J	CHIP C	100PF J		
C240			CK73FF1E104Z	CHIP C	0.10UF Z		
C241			CC73FCH1H100D	CHIP C	10PF D		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti-nation 仕向	Re-marks 備考
TC1			C05-0309-05	TRIMMING CAP 40PF		
CN1			E40-5139-05	FPC CONNECTOR(24P)		
CN2			E40-3240-05	PIN CONNECTOR(5P)		
CN3			E40-3242-05	PIN CONNECTOR(7P)		
CN4			E40-3240-05	PIN CONNECTOR(5P)		
CN5			E40-3238-05	PIN CONNECTOR(3P)		
CN6			E40-3239-05	PIN CONNECTOR(4P)		
CN7 -9			E04-0157-05	RF COAXIAL JACK		
TP1			E23-0512-05	TERMINAL		
TP2			E23-0464-05	TERMINAL		
TP3 ,4			E23-0512-05	TERMINAL		
TP5			E23-0464-05	TERMINAL		
TP6 ,7			E23-0512-05	TERMINAL		
TP8			E23-0464-05	TERMINAL		
TP9 -12			E23-0512-05	TERMINAL		
TP13,14			E23-0464-05	TERMINAL		
A1 -3			F11-0817-04	SHIELDING CASE		
A4 ,5			F11-0818-34	SHIELDING COVER		
L1 ,2			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L3			L32-0649-05	OSCILLATING COIL (VCO)		
L4			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L5 ,6			L40-4701-17	SMALL FIXED INDUCTOR(47UH)		
L7		*	L34-4196-05	B.P.F 12.9-12.8MHZ		
L8		*	L34-4197-05	B.P.F 12.9-12.8MHZ		
L9		*	L34-4196-05	B.P.F 12.9-12.8MHZ		
L10		*	L34-4198-05	B.P.F 9.285MHZ		
L11		*	L34-4199-05	B.P.F 9.285MHZ		
L12		*	L34-4198-05	B.P.F 9.285MHZ		
L13 ,14			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L15			L32-0198-05	OSCILLATING COIL(VCO)		
L16			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L17 ,18			L40-3301-17	SMALL FIXED INDUCTOR(33UH)		
L19 ,20			L34-2063-15	TUNING COIL 40MHZ		
L21		*	L34-4200-05	B.P.F 35.05-35.55MHZ		
L22		*	L34-4201-05	B.P.F 35.05-35.55MHZ		
L23		*	L34-4200-05	B.P.F 35.05-35.55MHZ		
L24			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L25 ,26			L40-6891-17	SMALL FIXED INDUCTOR(6.8UH)		
L27 ,28		*	L40-1201-17	SMALL FIXED INDUCTOR(12UH)		
L29 ,30			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L31			L32-0666-15	OSCILLATING COIL (VCO)		
L32			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L33 ,34		*	L40-2701-17	SMALL FIXED INDUCTOR(27UH)		
L35		*	L34-4202-05	B.P.F 25.45-25.35MHZ		
L36		*	L34-4203-05	B.P.F 25.45-25.35MHZ		
L37		*	L34-4202-05	B.P.F 25.45-25.35MHZ		
L38			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L39 ,40		*	L40-5601-17	SMALL FIXED INDUCTOR(56UH)		
L41		*	L34-4196-05	B.P.F 12.545-12.535MHZ		
L42		*	L34-4197-05	B.P.F 12.545-12.535MHZ		
L43		*	L34-4196-05	B.P.F 12.545-12.535MHZ		
L44		*	L34-4200-05	B.P.F 38.205-38.215MHZ		
L45		*	L34-4201-05	B.P.F 38.205-38.215MHZ		

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Ref No 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
L46		*	L34-4200-05	B.P.F 38.205-38.215MHZ		
L47			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L48			L40-8282-17	SMALL FIXED INDUCTOR(0.82UH)		
L49			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L50			L40-1892-17	SMALL FIXED INDUCTOR(1.8UH)		
L51 ,52			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L53			L40-1092-17	SMALL FIXED INDUCTOR(10UH)		
L54			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L55			L40-1092-17	SMALL FIXED INDUCTOR(10UH)		
L56			L33-0663-05	CHOKE COIL 1UH		
L57		*	L34-4195-05	TUNING COIL 50.75MHZ		
L58			L34-1124-05	COIL		
X1		*	L77-1423-05	CRYSTAL RESONATOR(50.75MHZ		
R1			RS14DB3A220J	FL-PROOF RS 22 J 1W		
R2 148			RK73FB2AXXXJ	CHIP R		
IC1			AN78M08	IC(VOLTAGE REGULATOR/ +8V)		
IC1		*	LPC78M08	IC(VOLTAGE REGULATOR/ +8V)		
D1			RLS73	CHIP DIODE		
D2			1SV166	CHIP DIODE		
D3			RLS73	CHIP DIODE		
D4			1SV166	CHIP DIODE		
D5			RLS73	CHIP DIODE		
D6			1SV166	CHIP DIODE		
D7		*	RLZJ12B	CHIP ZENER DIODE(12V		
D8			RLS73	CHIP DIODE		
D9		*	RLZJ9.1B	CHIP ZENER DIODE(9.1V)		
IC2			CX-7925B	IC(DIGITAL SELECT PLL)		
IC3			M54459L	IC(PRE SCALER)		
IC4 ,5			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC6			CX-7925B	IC(DIGITAL SELECT PLL)		
IC7		*	MB467	IC(DIV 1/100)		
IC8			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC9			SN74LS73AN	IC(J-K FLIP FLOP)		
IC10			CX-7925B	IC(DIGITAL SELECT PLL)		
IC11			M54459L	IC(PRE SCALER)		
IC12			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC13		*	MB467	IC(DIV 1/100)		
IC14-16			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC17			CX 7925B	IC(DIGITAL SELECT PLL)		
IC18			NJM4558SD	IC(OP AMP X2)		
Q1			2SC2712(Y)	CHIP TRANSISTOR		
Q2 6			2SC2714(Y)	CHIP TRANSISTOR		
Q7 ,8			2SC2712(Y)	CHIP TRANSISTOR		
Q9 ,10			2SC2714(Y)	CHIP TRANSISTOR		
Q11 ,12			2SC2712(Y)	CHIP TRANSISTOR		
Q13			2SC2714(Y)	CHIP TRANSISTOR		
Q14		*	2SC2996(Y)	CHIP TRANSISTOR		
Q15 -17			2SC2714(Y)	CHIP TRANSISTOR		
Q18 21			DTC114EK	DIGITAL TRANSISTOR		
Q22 ,23			DTC114TK	DIGITAL TRANSISTOR		
		*	X58-3630-01	SUB UNIT(VCO)		
			X59-3440-00	MODULE UNIT(VCO1)		
			X59-3450-01	MODULE UNIT(LPF)		

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Ref No. 参照番号	Address 位置	New Parts 新	Parts No 部品番号	Description 部品名／規格		Destination 仕向	Remarks 備考
CAR UNIT (X50-3110-XX) -00 : TS-950S -01 : TS-950SD							
C1			CK73FB1E103K	CHIP C	0.010UF K		
C2			CE04EW1A470M	ELECTRO	47UF 10WV		
C3			CK73FB1H102K	CHIP C	1000PF K		
C4			CK73FB1E103K	CHIP C	0.010UF K		
C5			CK73FB1H102K	CHIP C	1000PF K		
C6			CE04EW1C470M	ELECTRO	47UF 16WV		
C7			CQ92M1H472K	MYLAR	4700PF K		
C8			CQ92M1H223K	MYLAR	0.022UF K		
C9			C91-0105-05	CERAMIC	0.0047UF K		
C10			CK73FB1E103K	CHIP C	0.010UF K		
C11			CE04EW1C470M	ELECTRO	47UF 16WV		
C12			CC73FRH1H470J	CHIP C	47PF J		
C13 -14			CC73FCH1HXXXJ	CHIP C			
C15 -17			CK73FB1E103K	CHIP C	0.010UF K		
C18			CE04EW1A470M	ELECTRO	47UF 10WV		
C19			CK73FB1E103K	CHIP C	0.010UF K		
C20			CK73FF1E104Z	CHIP C	0.10UF Z		
C21 -23			CK73FB1HXXXK	CHIP C			
C24 ,25			CK73FF1E104Z	CHIP C	0.10UF Z		
C26			CE04EW1E470M	ELECTRO	47UF 25WV		
C27			CK73FF1E104Z	CHIP C	0.10UF Z		
C28			CK73FB1E103K	CHIP C	0.010UF K		
C29			CE04EW1A470M	ELECTRO	47UF 10WV		
C30			CK73FB1H102K	CHIP C	1000PF K		
C31			CK73FB1E103K	CHIP C	0.010UF K		
C32			CK73FB1H102K	CHIP C	1000PF K		
C33			CE04EW1C470M	ELECTRO	47UF 16WV		
C34			CQ92M1H472K	MYLAR	4700PF K		
C35			CQ92M1H223K	MYLAR	0.022UF K		
C36			C91-0105-05	CERAMIC	0.0047UF K		
C37			CK73FB1H102K	CHIP C	1000PF K		
C38			CE04EW1C470M	ELECTRO	47UF 16WV		
C39			CC73FRH1H220J	CHIP C	22PF J		
C40 -41			CC73FCH1HXXXJ	CHIP C			
C42 ,43			CK73FB1H102K	CHIP C	1000PF K		
C44			CK73FB1E103K	CHIP C	0.010UF K		
C45			CE04EW1A470M	ELECTRO	47UF 10WV		
C46			CK73FB1H102K	CHIP C	1000PF K		
C47			CK73FF1E104Z	CHIP C	0.10UF Z		
C48 -50			CK73FB1HXXXK	CHIP C			
C51 -55			CK73FF1E104Z	CHIP C	0.10UF Z		
C56 -62			CK73FB1E103K	CHIP C	0.010UF K		
C63			CE04EW1A470M	ELECTRO	47UF 10WV		
C64			CK73FB1H102K	CHIP C	1000PF K		
C65			CK73FB1E103K	CHIP C	0.010UF K		
C66			CK73FB1H102K	CHIP C	1000PF K		
C67			CE04EW1C470M	ELECTRO	47UF 16WV		
C68			CQ92M1H472K	MYLAR	4700PF K		
C69			CQ92M1H223K	MYLAR	0.022UF K		
C70			C91-0105-05	CERAMIC	0.0047UF K		
C71			CK73FB1H102K	CHIP C	1000PF K		
C72			CE04EW1C470M	ELECTRO	47UF 16WV		
C73			CC73FRH1H220J	CHIP C	22PF J		

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C74 -75			CC73FCH1HXXXJ	CHIP C			
C76 ,77			CK73FB1H102K	CHIP C	1000PF K		
C78			CK73FB1E103K	CHIP C	0.010UF K		
C79			CE04EW1A470M	ELECTRO	47UF 10WV		
C80			CK73FB1H102K	CHIP C	1000PF K		
C81			CK73FF1E104Z	CHIP C	0.10UF Z		
C82 -84			CK73FB1HXXXK	CHIP C			
C85 -89			CK73FF1E104Z	CHIP C	0.10UF Z		
C90 -96			CK73FB1E103K	CHIP C	0.010UF K		
C97			CE04EW1A470M	ELECTRO	47UF 10WV		
C98			CK73FB1H102K	CHIP C	1000PF K		
C99			CK73FB1E103K	CHIP C	0.010UF K		
C100			CK73FB1H102K	CHIP C	1000PF K		
C101			CE04EW1C470M	ELECTRO	47UF 16WV		
C102			CQ92M1H472K	MYLAR	4700PF K		
C103			CQ92M1H223K	MYLAR	0.022UF K		
C104			C91-0105-05	CERAMIC	0.0047UF K		
C105			CK73FB1E103K	CHIP C	0.010UF K		
C106			CE04EW1C470M	ELECTRO	47UF 16WV		
C107			CC73FRH1H270J	CHIP C	27PF J		
C108-109			CC73FCH1HXXXJ	CHIP C			
C110			CK73FB1E103K	CHIP C	0.010UF K		
C111-112			CC73FCH1HXXXJ	CHIP C			
C113-118			CK73FB1E103K	CHIP C	0.010UF K		
C119-120			CC73FCH1HXXXJ	CHIP C			
C121,122			CK73FB1H102K	CHIP C	1000PF K		
C123			CK73FB1E103K	CHIP C	0.010UF K		
C124-126			CC73FCH1HXXXJ	CHIP C			
C127-129			CK73FB1E103K	CHIP C	0.010UF K		
C130-133			CK73FF1E104Z	CHIP C	0.10UF Z		
C134-136			CK73FB1E103K	CHIP C	0.010UF K		
C137			CK73FF1E104Z	CHIP C	0.10UF Z		
C138-140			CK73FB1HXXXK	CHIP C			
C141,142			CK73FF1E104Z	CHIP C	0.10UF Z		
C143			CE04EW1E470M	ELECTRO	47UF 25WV		
C144			CK73FF1E104Z	CHIP C	0.10UF Z		
C145,146			CK73FB1E103K	CHIP C	0.010UF K		
C147			CE04EW1A470M	ELECTRO	47UF 10WV		
C148			CK73FB1E103K	CHIP C	0.010UF K		
C149			CK73FF1E104Z	CHIP C	0.10UF Z		
C150-152			CK73FB1HXXXK	CHIP C			
C153,154			CK73FF1E104Z	CHIP C	0.10UF Z		
C155			CE04EW1E470M	ELECTRO	47UF 25WV		
C156-161			CK73FF1E104Z	CHIP C	0.10UF Z		
C162			CE04EW1A470M	ELECTRO	47UF 10WV		
C163			CQ92M1H472K	MYLAR	4700PF K		
C164			CS15E1V0R1M	TANTAL	0.1UF 35WV		
C165			C91-0117-05	CERAMIC	0.01UF K		
C166			CK73FB1E103K	CHIP C	0.010UF K		
C167-170			CC73FCH1HXXXJ	CHIP C			
C171			CK73FB1E103K	CHIP C	0.010UF K		
C172			CE04EW1C470M	ELECTRO	47UF 16WV		
C173-175			CK73FB1E103K	CHIP C	0.010UF K		
C176			CE04EW1A470M	ELECTRO	47UF 10WV		
C177			CC73FCH1H050C	CHIP C	5.0PF C		

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C178			CK73FB1E103K	CHIP C 0.010UF K		
C179,180			CC73FSL1H121J	CHIP C 120PF J		
C181			CK73FB1E103K	CHIP C 0.010UF K		
C182			CC73FCH1H470J	CHIP C 47PF J		
C183 186			CK73FB1E103K	CHIP C 0.010UF K		
C187			CE04EW1A470M	ELECTRO 47UF 10WV		
C188			CK73FB1E103K	CHIP C 0.010UF K		
C189-191			CC73FCH1HXXXJ	CHIP C		
C192-194			CK73FB1E103K	CHIP C 0.010UF K		
C195,196			CC73FCH1H050C	CHIP C 5.0PF C		
C197-199			CK73FB1E103K	CHIP C 0.010UF K		
C200-202			CC73FCH1HXXXJ	CHIP C		
C203			CK73FF1E104Z	CHIP C 0.10UF Z		
C204			CE04EW1A470M	ELECTRO 47UF 10WV		
C205-207			CK73FB1HXXXK	CHIP C		
C208-211			CK73FF1E104Z	CHIP C 0.10UF Z		
C212			CK73FB1E103K	CHIP C 0.010UF K		
C213			CE04EW1A470M	ELECTRO 47UF 10WV		
C214			CK73FB1E103K	CHIP C 0.010UF K		
C215-221			CK73FB1HXXXK	CHIP C		
C222-226			CK73FB1E103K	CHIP C 0.010UF K		
TC1			C05-0044-05	TRIMMING CAP(30PF)		
TC2			C05-0355-05	TRIMMING CAP(30PF)		
CN1			E40-3239-05	PIN CONNECTOR(4P)		
CN2			E40-3237-05	PIN CONNECTOR(2P)		
CN3			E40-3239-05	PIN CONNECTOR(4P)		
CN4			E40-3238-05	PIN CONNECTOR(3P)		
CN5			E40-3237-05	PIN CONNECTOR(2P)		
CN6			E40-3239-05	PIN CONNECTOR(4P)		
CN7			E40-3238-05	PIN CONNECTOR(3P)		
CN8 ,9			E40-3237-05	PIN CONNECTOR(2P)		
CN10			E04-0154-05	RF COAXIAL JACK		
CN11			E40-3237-05	PIN CONNECTOR(2P)		
CN12			E40-3241-05	PIN CONNECTOR(6P)		
CN13			E40-3242-05	PIN CONNECTOR(7P)		
J1 ,2			E13-0166-05	PIN JACK(EXT.STD)		
J3			E06-0859-05	DIN SOCKET(SCOPE DIN 8P)		
J4			E06-0658-05	DIN SOCKET(ACC1 DIN 6P)		
TP1 -4			E23-0464-05	TERMINAL		
TP5 ,6			E23-0512-05	TERMINAL		
A1 -4			F11-0817-04	SHIELDING COVER		
CF1			L72-0350-05	CERAMIC FILTER(9.295MHZ)		
CF2			L72-0369-05	CERAMIC FILTER(10.695MHZ)		
L1 ,2			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L3			L32-0197-05	OSCILLATING COIL (VCO)		
L4			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L5		*	L40-6801-17	SMALL FIXED INDUCTOR(68UH)		
L6			L40-4711-14	SMALL FIXED INDUCTOR(470UH)		
L7		*	L40-6801-17	SMALL FIXED INDUCTOR(68UH)		
L8 ,9			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L10			L32-0639-05	OSCILLATING COIL (VCO)		
L11			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L12 ,13			L40-2211-17	SMALL FIXED INDUCTOR(220UH)		

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L14		*	L34-4204-15	TUNING COIL		
L15 ,16			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L17			L32-0639-05	OSCILLATING COIL (VCO)		
L18			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L19 ,20			L40-2211-17	SMALL FIXED INDUCTOR(220UH)		
L21		*	L34-4204-15	TUNING COIL		
L22 ,23			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L24			L32-0649-05	OSCILLATING COIL (VCO)		
L25 ,26		*	L40-1201-17	SMALL FIXED INDUCTOR(12UH)		
L27 ,28		*	L40-6811-14	SMALL FIXED INDUCTOR(680UH)		
L29			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L30 ,31			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L32			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L33			L40-4701-17	SMALL FIXED INDUCTOR(47UH)		
L35			L40-6882-17	SMALL FIXED INDUCTOR(0.68UH)		
L36			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L37 ,38		*	L40-1201-17	SMALL FIXED INDUCTOR(12UH)		
L39 ,40			L40-6891-17	SMALL FIXED INDUCTOR(6.8UH)		
L41 ,42			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
X1			L77-0963-05	CRYSTAL RESONATOR(20MHZ)		
X2			L77-1394-15	TCXO 20MHZ		D
R1 -144			RK73FB2AXXXJ	CHIP R		
W3			R92-0670-05	CHIP REST 0 OHM		
S1			S31-1411-05	SLIDE SWITCH		
S2		*	S31-2420-05	SLIDE SWITCH		
D1			RLS73	CHIP DIODE		
D2			1SV166	CHIP DIODE		
D3			RLS73	CHIP DIODE		
D4			1SV166	CHIP DIODE		
D5			RLS73	CHIP DIODE		
D6			1SV166	CHIP DIODE		
D7			RLS73	CHIP DIODE		
D8 ,9			1SV166	CHIP DIODE		
D10		*	RLZJ12B	CHIP ZENER DIODE(12V)		
D11 -13			DAP202(K)	CHIP DIODE		
D14			RLS73	DIODE		
D15			RLZJ6.8B	CHIP ZENER DIODE(6.8V)		
IC1			CX-7925B	IC(DIGITAL SELECT PLL)		
IC2			M54459L	IC(DIV 1/100)		
IC3			CX-7925B	IC(DIGITAL SELECT PLL)		
IC4			M54459L	IC(DIV 1/100)		
IC5			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC6			CX-7925B	IC(DIGITAL SELECT PLL)		
IC7			M54459L	IC(DIV 1/100)		
IC8			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC9			CX-7925B	IC(DIGITAL SELECT PLL)		
IC10,11			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC12			M54459L	IC(DIV 1/100)		
IC13		*	MC14568BCP	IC(PLL)		
IC14		*	M74LS90P	IC(DIV)		
IC14			SN74LS90N	IC(DIV)		
IC15			TC4013BP	IC(D FLIP-FLOP X2)		
IC16			MC14569BCP	IC		

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IC17		*	TC4556BP	IC			
Q1 ,2			2SC2712(Y)	CHIP TRANSISTOR			
Q3			2SC2714(Y)	CHIP TRANSISTOR			
Q4			2SC2712(Y)	CHIP TRANSISTOR			
Q5 -7			2SC2714(Y)	CHIP TRANSISTOR			
Q8 -12			2SC2712(Y)	CHIP TRANSISTOR			
Q13 15			2SC2714(Y)	CHIP TRANSISTOR			
Q16			2SC2712(Y)	CHIP TRANSISTOR			
Q17 ,18			2SC2712(Y)	CHIP TRANSISTOR			
Q19			2SA1162(Y)	CHIP TRANSISTOR			
			X59-3440-00	MODULE UNIT(VCO)			
			X59-3450-01	MODULE UNIT(LPF)			
		*	X59-3640-00	MODULE UNIT(MKR)			
		*	X59-3650-00	MODULE UNIT(SFT)			
FILTER UNIT (X51-3060-XX) -01 : TS-950S (K,M,W,X,P) -11 : TS-950SD (K,M,W,X,P) -61 : TS-950S (W2) -62 : TS-950SD (W2)							
C1 -13			CK45F1H103Z	CERAMIC	0.010UF Z		
C14 ,15			CE04EW1E100M	ELECTRO	10UF 25WV		
C16			C91-0119-05	CERAMIC	0.047UF K		
C17			CC45CH2H030C	CERAMIC	3.0PF C		
C18			CC45CH1H560J	CERAMIC	56PF J		
C19			CC45CH1H101J	CERAMIC	100PF J		
C20 ,21			C91-0119-05	CERAMIC	0.047UF K		
C22			CC45SL1H150J	CERAMIC	15PF J		
C23			CK45F1H103Z	CERAMIC	0.010UF Z		
C101			CM93D2H102J	MICA	1000PF J		
C102			CC45SL2H431J	CERAMIC	430PF J		
C103			CM93D2H222J	MICA	2200PF J		
C104			CC45SL2H221J	CERAMIC	220PF J		
C105			CM93D2H122J	MICA	1200PF J		
C106,107			CC45SL2H331J	CERAMIC	330PF J		
C108			CC45SL2H241J	CERAMIC	240PF J		
C109			CM93D2H122J	MICA	1200PF J		
C110			CC45SL2H470J	CERAMIC	47PF J		
C111			CC45SL2H560J	CERAMIC	56PF J		
C112			CC45SL2H391J	CERAMIC	390PF J		
C113			CC45SL2H221J	CERAMIC	220PF J		
C114			CC45SL2H241J	CERAMIC	240PF J		
C115			CC45SL2H121J	CERAMIC	120PF J		
C116			CC45SL2H301J	CERAMIC	300PF J		
C117			CC45SL2H331J	CERAMIC	330PF J		
C118			CC45SL2H560J	CERAMIC	56PF J		
C119			CC45SL2H331J	CERAMIC	330PF J		
C120			CC45SL2H151J	CERAMIC	150PF J		
C121			CC45SL2H101J	CERAMIC	100PF J		
C122			CC45SL2H391J	CERAMIC	390PF J		
C123		*	CC45SL2H360J	CERAMIC	36PF J		
C124			CC45SL2H241J	CERAMIC	240PF J		
C125		*	CC45SL2H131J	CERAMIC	130PF J		
C126			CC45SL2H470J	CERAMIC	47PF J		
C127			CC45SL2H301J	CERAMIC	300PF J		
C128		*	CC45SL2H240J	CERAMIC	24PF J		
C129		*	CC45SL2H201J	CERAMIC	200PF J		
C130			CC45SL2H101J	CERAMIC	100PF J		
C131			CC45SL2H330J	CERAMIC	33PF J		
C132			CC45SL2H221J	CERAMIC	220PF J		

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C132			CC45SL2H100D	CERAMIC 10PF D		
C134			CC45SL2H121J	CERAMIC 120PF J		
C135			CC45SL2H820J	CERAMIC 82PF J		
C136		*	CC45SL2H300J	CERAMIC 30PF J		
C137			CC45SL2H151J	CERAMIC 150PF J		
C138			CC45SL2H100D	CERAMIC 10PF D		
C139			CC45SL2H820J	CERAMIC 82PF J		
C140			CC45SL2H151J	CERAMIC 150PF J		
C141,142			CC45SL2H470J	CERAMIC 47PF J		
C143			CC45SL2H390J	CERAMIC 39PF J		
C144			CC45SL2H470J	CERAMIC 47PF J		
TC1			C05-0030 15	TRIMMING CAP(20PF)		
CN1 ,2			E04-0157-05	RF COAXIAL JACK		
CN3			E40-3237-05	PIN CONNECTOR(2P)		
CN4			E04-0157-05	RF COAXIAL JACK		
CN5			E40-3238-05	PIN CONNECTOR(3P)		
CN6			E40-3240-05	PIN CONNECTOR(5P)		
CN7			E40-5067-05	PIN CONNECTOR(10P)		
CN8			E40-3240-05	PIN CONNECTOR(5P)		
CN10,11			E40-0517-05	PIN CONNECTOR		S
CN12,13			E40-0517 05	PIN CONNECTOR		
W23		*	E31-6080-05	WIRE WITH CONNECTOR		
CF1			L72-0333-05	CERAMIC FILTER(CFJ455K12)		S
L1			L39-0406-05	TROIDAL COIL		
L2 -8			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L9 ,10			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L11			L40-1011-14	SMALL FIXED INDJCTOR(100UH)		
L12 ,13			L34-0941-05	TUNING COIL		
L101		*	L39-0456-05	TROIDAL COIL (3.6UH)		
L102		*	L39-0457-05	TROIDAL COIL (4.5UH)		
L103		*	L39-0458-05	TROIDAL COIL (1.9UH)		
L104		*	L39-0459-05	TROIDAL COIL (2.4UH)		
L105		*	L39-0460-05	TROIDAL COIL (1.0UH)		
L106		*	L39-0461-05	TROIDAL COIL (1.2UH)		
L107		*	L39-0462-05	TROIDAL COIL (0.7UH)		
L108		*	L39-0463-05	TROIDAL COIL (0.9UH)		
L109		*	L34-1278-05	COIL 9.7D 8.5T		
L110		*	L34-1277-05	COIL 9.7D 9.5T		
L111		*	L34-1280-05	COIL 9.7D 6.5T		
L112		*	L34-1279-05	COIL 9.7D 7.5T		
L113		*	L34-1282-05	COIL 9.7D 4.5T		
L114		*	L34-1281-05	COIL 9.7D 5.5T		
T1			L92-0102-05	TROIDAL CORE		
T2 -6			L92-0104-05	TROIDAL T68-2		
T7 -9			L92-0105-05	TROIDAL T68-6		
XF1			L71-0266-05	MCF(8.83MHZ)		
CP1			R90-0286-05	MULTI-COMP 4.7KX4		
CP2			R90-0455-05	MULTI-COMP 4.7KX8 J 1/4W		
CP3		*	R90-0713-05	MULTI-COMP 0.1UFX9		
R1			RD14CB2E270J	RD 27 J 1/4W		
R2			RD14CB2E330J	RD 33 J 1/4W		
R3			RD14BB2C100J	RD 10 J 1/6W		
R4			RD14BB2C103J	RD 10K J 1/6W		
R5			RD14BB2C472J	RD 4.7K J 1/6W		

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VR1			R12-0104 05	TRIMMING POT. 220			
W1 ,2			R92 0150-05	JUMPER REST 0 OHM			
W22			R92-0150 05	JUMPER REST 0 OHM			
W24			R92-0150-05	JUMPER REST 0 OHM			
K1 -14			S51 1420-05	RELAY			
K15			S51-1429-05	RELAY			
D1 7			1S1555	DIODE			
D8 ,9			1SS101	DIODE			
D10			1S1555	DIODE			
D11 ,12			MC921	DIODE			
D13 ,14			1S1555	DIODE			
D15			DSP-301N	DIODE			
IC1		*	M74LS145N	IC(BCD-DECIMAL)			
IC1			M74LS145P	IC(BCD-DECIMAL)			
IC2			M54581P	IC(INVERTER)			
IC3			AN78N05	IC(5V AVR)			
Q1			2SA562(Y)	TRANSISTOR			
CONTROL UNIT (X53-3230-00)							
C1			CE04EW1C100M	ELECTRO	10UF	16WV	
C2			CE04EW1C220M	ELECTRO	22UF	16WV	
C3			CE04EW1C102M	ELECTRO	1000UF	16WV	
C4			CE04EW1H010M	ELECTRO	1.0UF	50WV	
C5			CE04EW1H100M	ELECTRO	10UF	50WV	
C6			C90-0866-05	ELECTRO	470UF	6.3WV	
C7			CE04EW1A221M	ELECTRO	220UF	10WV	
C8			CE04EW1C101M	ELECTRO	100UF	16WV	
C9			CE04EW1H010M	ELECTRO	1UF	50WV	
C10 ,11			CE04EW1C100M	ELECTRO	10UF	16WV	
C12			CK73EF1C105Z	CHIP C	1.0UF	Z	
C13 ,14			CE04EW1C101M	ELECTRO	100UF	16WV	
C15			CE04EW1H4R7M	ELECTRO	4.7UF	50WV	
C16			CE04EW1A470M	ELECTRO	47UF	10WV	
C17			CE04EW1C100M	ELECTRO	10UF	16WV	
C18			CE04EW1A470M	ELECTRO	47UF	10WV	
C19			CK73EF1C105Z	CHIP C	1.0UF	Z	
C20 -23			CK73FB1H103K	CHIP C	0.010UF	K	
C24			CC73FCH1H101J	CHIP C	100PF	J	
C25 -26			CK73FB1HXXXK	CHIP C			
C27			CK73FF1E104Z	CHIP C	0.10UF	Z	
C28			CK73EF1E474Z	CHIP C	0.47UF	Z	
C29 -33			CK73FB1HXXXK	CHIP C			
C34			CK73FF1E104Z	CHIP C	0.10UF	Z	
C35 -39			CK73FB1HXXXK	CHIP C			
C40 43			CK73FF1E104Z	CHIP C	0.10UF	Z	
C44 -49			CK73FB1HXXXK	CHIP C			
C50 ,51			CC73FCH1H101J	CHIP C	100PF	J	
C52			CK73FB1H103K	CHIP C	0.010UF	K	
C53			CQ92M1H563K	MYLAR	0.056UF	K	
C54 -58			CK73FB1HXXXK	CHIP C			
C59			CE04EW1C470M	ELECTRO	47UF	16WV	
C60			CK73FF1E104Z	CHIP C	0.1UF	Z	
C61			CK45B1H103K	CERAMIC	0.010UF	K	
CN1			E40-3238-05	PIN CONNECTOR(3P)			

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CN2 ,3			E40-3237-05	PIN CONNECTOR(2P)		
CN4			E40-3238-05	PIN CONNECTOR(3P)		
CN5 ,6			E40-3237-05	PIN CONNECTOR(2P)		
CN7			E40-3240-05	PIN CONNECTOR(5P)		
CN8			E40-3242-05	PIN CONNECTOR(7P)		
CN9			E40-3238-05	PIN CONNECTOR(3P)		
CN10			E40-3240-05	PIN CONNECTOR(5P)		
CN11			E40-3238-05	PIN CONNECTOR(3P)		
CN12			E40-3239-05	PIN CONNECTOR(4P)		
CN13			E40-3238-05	PIN CONNECTOR(3P)		
CN14 ,15			E40-3239-05	PIN CONNECTOR(4P)		
CN16			E40-3240-05	PIN CONNECTOR(5P)		
CN17			E40-3237-05	PIN CONNECTOR(2P)		
CN18			E40-3241-05	PIN CONNECTOR(6P)		
CN19			E40-5131-05	FPC CONNECTOR(16P)		
CN20		*	E40-5333-05	FPC CONNECTOR(14P)		
CN21			E40-3239-05	PIN CONNECTOR(4P)		
CN22			E40-3241-05	PIN CONNECTOR(6P)		
CN23			E40-3237-05	PIN CONNECTOR(2P)		
CN24			E40-3238-05	PIN CONNECTOR(3P)		
CN25			E40-3240-05	PIN CONNECTOR(5P)		
CN26			E40-3238-05	PIN CONNECTOR(3P)		
CN27		*	E40-0617-05	PIN CONNECTOR(6P)		
CN28		*	E40-5336-05	PIN CONNECTOR(6P)		
CN29		*	E40-5335-05	PIN CONNECTOR(3P)		
CN30			E40-0317-05	PIN CONNECTOR(3P)		
CN31			E40-3240-05	PIN CONNECTOR(5P)		
CN32,33			E23-0512-05	TERMINAL		
		*	F02-0438-04	HEAT SINK(CAP/ADDITION TYPE)		
			G02-0574-04	FLAT SPRING		
L1			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L2			L40-3391-13	SMALL FIXED INDUCTOR(3.3UH)		
L3 ,4			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
X1		*	L78-0057-05	RESONATOR(700HZ)		
R1 -14			RK73FB2AXXXJ	CHIP R		
R15			R92-0670-05	CHIP R 0 OHM		
R16 -74			RK73FB2AXXXJ	CHIP R		
R75			R92-0670-05	CHIP R 0 OHM		
R76 -103			RK73FB2AXXXJ	CHIP R		
R104			RD14BB2C222J	RD 2.2K J 1/6W		
R105			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R106			RD14BB2C223J	RD 22K J 1/6W		
R107			RD14BB2C103J	RD 10K J 1/6W		
VR1		*	R12-3103-05	TRIMMING POT. 47K		
VR2		*	R12-1070-05	TRIMMING POT. 1K		
VR3 -5		*	R12-3100-05	TRIMMING POT. 10K		
VR6 ,7		*	R12-3103-05	TRIMMING POT. 47K		
VR8 ,9		*	R12-3100-05	TRIMMING POT. 10K		
VR10		*	R12-1073-05	TRIMMING POT. 4.7K		
VR11		*	R12-3100-05	TRIMMING POT. 10K		
VR12		*	R12-3103-05	TRIMMING POT. 47K		
VR13		*	R12-3102-05	TRIMMING POT. 33K		
W2			R92-0150-05	JUMPER REST 0 OHM		

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W6			R92-1061-05	JUMPER RESISTOR 0 OHM		
S1			S31-1411-05	SLIDE SWITCH		
S2		*	S59-4402-05	DIP SWITCH		
D1			LT8001P	DIODE		
D2		*	RLZJ12B	CHIP ZENER DIODE 12V		
D3			RLS73	CHIP DIODE		
D5		*	RLZJ4.7B	CHIP ZENER DIODE(4.7V)		
D6			RLS73	CHIP DIODE		
D7			HSM88AS	CHIP DIODE		
D8		*	RLZ4.7B	CHIP ZENER DIODE(4.7V)		
D9			RLS73	CHIP DIODE		
D10 ,11			DAN202(K)	CHIP DIODE		
D12		*	RLZ15B	CHIP ZENER DIODE(15V)		
D13 -16			RLS73	CHIP DIODE		
D17			DAN202(K)	CHIP DIODE		
D18 -28			RLS73	CHIP DIODE		
D29			DAN202(K)	CHIP DIODE		
D30 -33			RLS73	CHIP DIODE		
IC1			TC4069UBF	IC(INVERTER X6)		
IC2			TC4011BF	IC(NAND X4)		
IC3 ,4			TC4066BF	IC(BILATERAL SWITCH X4)		
IC5			TC4069UBF	IC(INVERTER X6)		
IC6			TC4011BF	IC(NAND X4)		
IC7			JPC2002V	IC(OP AMP X2)		
IC8			NJM4558M	IC(OP AMP X2)		
IC9			TC4066BF	IC(BILATERAL SWITCH X4)		
IC10		*	TC4538BF	IC(ONE SHOT MULTI)		
IC11			NJM4558M	IC(OP AMP X2)		
IC12			AN78N08	IC(VOLUTAGE REGULATOR/ +35V)		
IC13			TC4069UBF	IC(INVERTER X6)		
IC14		*	UPD7564CS-114	IC(MICROPROCESSOR		
IC15			TC4011BF	IC(NAND X4)		
IC16			M51951BML	IC(SYSTEM RESET)		
Q1 -3			2SC2712(Y)	CHIP TRANSISTOR		
Q4			2SK208(GR)	CHIP FET		
Q5			2SC2712(Y)	CHIP TRANSISTOR		
Q6			DTC144EK	DIGITAL TRANSISTOR		
Q7			DTC124EK	DIGITAL TRANSISTOR		
Q8			DTC144EK	DIGITAL TRANSISTOR		
Q9			DTA124EK	DIGITAL TRANSISTOR		
Q10 ,11			2SC2712(Y)	CHIP TRANSISTOR		
Q12 -17			DTC124EK	DIGITAL TRANSISTOR		
Q18			DTC144WK	DIGITAL TRANSISTOR		
Q19			DTC114TK	DIGITAL TRANSISTOR		
		*	X59-3660-00	MODULE UNIT(CWT)		
		*	X59-3670-00	MODULE UNIT(MAP)		
		*	X59-3680-00	MODULE UNIT(TRX)		
		*	X59-3700-00	MODULE UNIT(ALC)		
AT UNIT (X53-3240-00)						
C1			CC45SL2H330J	CERAMIC 33PF J		
C2 -8			CK73FB1E103K	CHIP C 0.010UF K		
C9 -11			CK73FB1HXXXK	CHIP C		
C12			CE04EW1C470M	ELECTRO 47UF 16WV		

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Ref No. 参照番号	Address 位置	New Parts. 新	Parts No. 部品番号	Description 部品名／規格			Destination 仕向	Remarks 備考
C13 -19			CK73FB1E103K	CHIP C	0.010UF	K		
C20			CE04EW1C470M	ELECTRO	47UF	16WV		
C21 25			CK73FB1E103K	CHIP C	0.010UF	K		
C26			CE04EW1C470M	ELECTRO	47UF	16WV		
C27			CK73FB1E103K	CHIP C	0.010UF	K		
C28 ,29			CK73FB1H102K	CHIP C	1000PF	K		
C31 33			CK73FB1EXXXK	CHIP C				
C35			CE04EW1C470M	ELECTRO	47UF	16WV		
C36 -39			CK73FB1EXXXK	CHIP C				
C40			CK73FB1H472K	CHIP C	4700PF	K		
C41 ,42			CK73FB1E103K	CHIP C	0.010UF	K		
C43			CK73FB1H103K	CHIP C	0.010UF	K		
C44 -46			CK73FB1E103K	CHIP C	0.010UF	K		
C101-108			CK73FB1H103K	CHIP C	0.010UF	K		
TC1			C05-0031 15	TRIMMING CAP(10PF)				
VC1 ,2			C02-0023-05	VARIABLE CAPACITOR				
A5		*	D40-0633-15	GEAR ASSY				
CN1 ,2			E04 0157 05	RF COAXIAL JACK				
CN3			E40-3239-05	PIN CONNECTOR(4P)				
CN4			E40-3240-05	PIN CONNECTOR(5P)				
CN5			E40-3238-05	PIN CONNECTOR(3P)				
CN101			E40-5066 05	PIN CONNECTOR(9P)				
A2	1M	*	F10-1401-13	SHIELDING PLATE				
A1	1N	*	F11-1142-12	SHIELDING COVER				
A3	1M	*	F11-1143-14	SHIELDING COVER A				
A4	2N	*	F11-1144-04	SHIELDING COVER B				
L1			L39-0416-05	TROIDAL COIL				
L2			L39-0415-15	TROIDAL COIL				
L3 -6			L40-1011-13	SMALL FIXED INDUCTOR(100UH)				
L7 -13			L40-1011-14	SMALL FIXED INDUCTOR(100UH)				
L14 -17			L40-1011-13	SMALL FIXED INDUCTOR(100UH)				
L101 108			L40-1011-14	SMALL FIXED INDUCTOR(100UH)				
L109		*	L34-1276-05	COIL(20MM)				
L110		*	L39-0479-05	TROIDAL COIL	7MHZ			
L111			L34-2251-05	TROIDAL COIL	3.5MHZ			
L112		*	L39-0478-05	TROIDAL COIL	1.9MHZ			
T1 ,2			L92-0103-05	TROIDAL CORE				
T110-112			L92-0117-05	TROIDAL CORE				
K	1M, 1N		N87-3006-46	BRAZIER HEAD TAPTITE SCREW				
0	1M, 2N		N88-3006-46	FLAT HEAD TAPTITE SCREW				
			R12-3447-05	TRIMMING POT.				
R1 ,2			RD14BB2E101J	RD	100	J 1/4W		
R3			RK73FB2A102J	CHIP R	1.0K	J 1/10W		
R4			RD14BB2E470J	RD	47	J 1/4W		
R5 23			RK73FB2AXXXJ	CHIP R				
R24 ,25			RD14BB2E100J	RD	10	J 1/4W		
R26 -28			RK73FB2AXXXJ	CHIP R				
R29			RD14BB2C471J	RD	470	J 1/6W		
R30 -37			RK73FB2AXXXJ	CHIP R				
R38			RD14BB2C472J	RD	4.7K	J 1/6W		
R39 -50			RK73FB2AXXXJ	CHIP R				
VR1			R12-3126-05	TRIMMING POT.10K				

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VR2			R12-3128-05	TRIMMING POT.22K		
VR101,102		*	R01-3435-05	POTENTIOMETER 10K		
W23 28			R92-0679-05	CHIP R 0 OHM		
W29 47			R92-0670-05	CHIP R 0 OHM		
W48			R92-0150-05	JUMPER REST 0 OHM		
K1			S51-2407-05	RELAY		
K101 108		*	S51-1442-05	RELAY		
M1 ,2	2L		T42-0453-05	DC MOTOR ASSY		
D1 ,2			1N60	DIODE		
D3 -8			1SS226	CHIP DIODE		
D9 -12			1S1555	CHIP DIODE		
D13			DAN202(K)	DIODE		
D101 108			1S1555	DIODE		
IC1			SN74S74N	IC		
IC2 ,3			TC4066BP	IC(ANALOG/ DIGITAL SW)		
IC4 ,5			BA6109J2	IC(MOTOR DRIVER)		
IC6			NJM2903S	IC(DUAL COMPALATOR)		
IC7			NJM2904S	IC(OP AMP X2)		
IC8			NE555P	IC		
IC9 ,10			NJM2903S	IC(DJAL COMPALATOR)		
Q1 ,2			2SC2714(Y)	CHIP TRANSISTOR		
Q3			DTC114EK	DIGITAL TRANSISTOR		
Q4			2SA1204(Y)	CHIP TRANSISTOR		
Q5 ,6			DTC114EK	DIGITAL TRANSISTOR		
Q7			2SA1204(Y)	CHIP TRANSISTOR		
Q8 -10			DTC114EK	DIGITAL TRANSISTOR		
DISPLAY UNIT (X54-3080-00)						
C1			CE04EW1E470M	ELECTRO 47UF 25WV		
C2 ,3			CE04EW1H470M	ELECTRO 47UF 50WV		
C4 ,5			CE04EW1A471M	ELECTRO 470UF 10WV		
C6			CK73FB1E103K	CHIP C 0.010UF K		
C7 ,8			CK73FB1H103K	CHIP C 0.010UF K		
C9			CK73FB1E103K	CHIP C 0.010UF K		
C10 ,11			CK73FB1H471K	CHIP C 470PF K		
C12			CK73FB1E103K	CHIP C 0.010UF K		
C13 -17			CK73FB1H471K	CHIP C 470PF K		
C18 -33			CK73FB1E103K	CHIP C 0.010UF K		
C34 -37			CK73FB1H102K	CHIP C 1000PF K		
C38			CK73FF1E104Z	CHIP C 0.10UF Z		
C39 ,40			CC73FCH1H100D	CHIP C 10PF D		
C42 ,43			CK73FB1E103K	CHIP C 0.010UF K		
C44			CK73FB1H102K	CHIP C 1000PF K		
C45 -47			CK73FB1E103K	CHIP C 0.010UF K		
C48			CK73FF1E104Z	CHIP C 0.10UF Z		
C49			CK73FB1E103K	CHIP C 0.010UF K		
C50			CK73FF1E104Z	CHIP C 0.10UF Z		
C51			CK73FB1E103K	CHIP C 0.010UF K		
C52			CK73FF1E104Z	CHIP C 0.10UF Z		
C53			CK73FB1E103K	CHIP C 0.010UF K		
C54			CK73FF1E104Z	CHIP C 0.10UF Z		
C55 ,56			CK73FB1E103K	CHIP C 0.010UF K		
C57			CK73FF1E104Z	CHIP C 0.10UF Z		
C58			CK73FB1E103K	CHIP C 0.010UF K		

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C59 -60			CK73FB1HXXXK	CHIP C		
C61			C91-0433-05	MYLAR 390PF J		
C62 ,63			CK73FB1H472K	CHIP C 4700PF K		
C64 ,65			CK73FB1E103K	CHIP C 0.010UF K		
C66			CE04EW1A471M	ELECTRO 470UF 10WV		
CN1			E40-5133-05	FPC CONNECTOR(18P)		
CN2 -4			E40-3237-05	PIN CONNECTOR(2P)		
CN5			E40-5034-05	PIN CONNECTOR(10P)		
CN6			E40-3243-05	PIN CONNECTOR(8P)		
CN7			E40-3241-05	PIN CONNECTOR(6P)		
		*	J19-1435-03	HOLDER		
L1			L40-1011-13	SMALL FIXED INDUCTOR(100UH)		
L2			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L3			L40-1011-13	SMALL FIXED INDUCTOR(100UH)		
X1			L77-1380-05	CRYSTAL RESONATOR(11.0592MHZ)		
CP1			R90-0598-05	MULTI-COMP		
R1 ,2			RD14BB2C2R2J	RD 2.2 J 1/6W		
R3 -460			RK73FB2AXXXJ	CHIP R		
VR1			R12-3128-05	TRIMMING POT.22K		
W1 -3			R92-0150-05	JUMPER REST 0 OHM		
W4 ,5			R92-0679-05	CHIP R 0 OHM		
W6 -9			R92-0670-05	CHIP R 0 OHM		
W10			R92-1061-05	JUMPER REST 0 OHM		
D1			RLZJ11B	CHIP ZENER DIODE(11V)		
IC1		*	647180X0FS6JBE1	IC(SUB CPU)		
IC2 ,3		*	MB622180PF	IC(GATE ARRAY)		
IC4		*	TC74HC138AF	IC(CHIP SELECT)		
IC5 ,6		*	TC74HC574AF	IC(LATCH)		
IC7		*	TC74HC04AF	IC(INVERTER)		
IC8		*	TC74HC00AF	IC(NAND)		
IC9		*	TC74HC175AF	IC(LATCH)		
IC10			TC4011BF	IC(NAND X4)		
Q1 -20		*	2SA1163(GR)	CHIP TRANSISTOR		
Q21		*	2SA1201(O)	CHIP TRANSISTOR		
Q22 -25		*	2SA1163(GR)	CHIP TRANSISTOR		
Q26		*	2SA1201(O,Y)	CHIP TRANSISTOR		
Q27 -42		*	2SA1163(GR)	CHIP TRANSISTOR		
Q43 -62		*	2SA1163(GR)	CHIP TRANSISTOR		
Q63 -76		*	2SA1163(GR)	CHIP TRANSISTOR		
Q77 -84			FMG1	DIGITAL TRANSISTOR		
Q85 -90		*	2SA1163(GR)	CHIP TRANSISTOR		
Q91 -93		*	2SA1163(GR)	CHIP TRANSISTOR		
Q94			FMG1	DIGITAL TRANSISTOR		
Q95 -103		*	2SA1163(GR)	CHIP TRANSISTOR		
Q104			FMG1	DIGITAL TRANSISTOR		
Q105-112		*	2SA1163(GR)	CHIP TRANSISTOR		
Q113-116		*	2SA1163(GR)	CHIP TRANSISTOR		
Q117		*	2SA1201(O)	CHIP TRANSISTOR		
Q118-133		*	2SA1163(GR)	CHIP TRANSISTOR		
Q134-137		*	2SA1163(GR)	CHIP TRANSISTOR		
V1		*	FIP25AMW20	VACUUM TUBE		
SIGNAL UNIT (X57-3380-00)						
C1 -4			CK73FF1E104Z	CHIP C 0.10UF Z		

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C5			CK73FB1E223K	CHIP C	0.022UF	K		
C6 -29			CK73FF1EXXXZ	CHIP C				
C30			CK73EF1E474Z	CHIP C	0.47UF	Z		
C31 ,32			CK73FF1E104Z	CHIP C	0.10UF	Z		
C33 ,34			C91-1078-05	MYLAR	1800PF	J		
C35			CK73FB1E103K	CHIP C	0.010UF	K		
C36			CK73FF1E104Z	CHIP C	0.10UF	Z		
C37			CC73FSL1H151J	CHIP C	150PF	J		
C38			CK73EF1E224Z	CHIP C	0.22UF	Z		
C39			CK73FF1E104Z	CHIP C	0.10UF	Z		
C40			CK73EF1E474Z	CHIP C	0.47UF	Z		
C41 ,42			CK73FF1E104Z	CHIP C	0.10UF	Z		
C43 ,44			CC73FSL1H221J	CHIP C	220PF	J		
C45 -46			CK73FB1EXXXK	CHIP C				
C47			CK73EF1E474Z	CHIP C	0.47UF	Z		
C48			CE04EW1C101M	ELECTRO	100UF	16WV		
C49			CK73EF1C105Z	CHIP C	1.0UF	Z		
C50 -52			CK73FB1H102K	CHIP C	1000PF	K		
C53 ,54			CK73FF1E104Z	CHIP C	0.10UF	Z		
C55 ,56			CK73FB1E103K	CHIP C	0.010UF	K		
C57 -59			CK73FF1E104Z	CHIP C	0.10UF	Z		
C60			CK73EF1E474Z	CHIP C	0.47UF	Z		
C61			CK73FB1E103K	CHIP C	0.010UF	K		
C62 -64			CC73FSL1HXXXJ	CHIP C				
C65			CK73FB1E103K	CHIP C	0.010UF	K		
C66			CE04EW1H3R3M	ELECTRO	3.3UF	50WV		
C67			CK73FB1E223K	CHIP C	0.022UF	K		
C68			CE04EW1H010M	ELECTRO	1.0UF	50WV		
C69			CE04EW1C100M	ELECTRO	10UF	16WV		
C71			CE04EW1H2R2M	ELECTRO	2.2UF	50WV		
C72 ,73			CK73FB1E103K	CHIP C	0.010UF	K		
C74			CE04EW1C100M	ELECTRO	10UF	16WV		
C75			CK73FF1E104Z	CHIP C	0.10UF	Z		
C76			CE04EW1C100M	ELECTRO	10UF	16WV		
C77			CC73FSL1H101J	CHIP C	100PF	J		
C78			CK73FB1E223K	CHIP C	0.022UF	K		
C79			CE04EW1HR47M	ELECTRO	0.47UF	50WV		
C80 ,81			CK73FB1E223K	CHIP C	0.022UF	K		
C82 -87			CK73FF1E104Z	CHIP C	0.10UF	Z		
C88 -89			CC73FSL1HXXXJ	CHIP C				
C90 -96			CK73FF1EXXXZ	CHIP C				
C98			CK73FB1E153K	CHIP C	0.015UF	K		
C99			CK73FB1H182K	CHIP C	1800PF	K		
C100			CC73FCH1H330J	CHIP C	33PF	J		
C101			CK73FB1H222K	CHIP C	2200PF	K		
C102			CC73FSL1H470J	CHIP C	47PF	J		
C103			CK73FB1H561K	CHIP C	560PF	K		
C104,105			CE04EW1C100M	ELECTRO	10UF	16WV		
C106			CK73FF1E104Z	CHIP C	0.10UF	Z		
C107			CK73FB1H102K	CHIP C	1000PF	K		
C108			CE04EW1C330M	ELECTRO	33UF	16WV		
C109			CE04EW1H2R2M	ELECTRO	2.2UF	50WV		
C110-111			CC73FSL1HXXXJ	CHIP C				
C112			CE04EW1C330M	ELECTRO	33UF	16WV		
C113			CE04EW1H010M	ELECTRO	1.0UF	50WV		

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C114			CK73FF1E104Z	CHIP C	0.10UF Z		
C115 116			CC73FSL1HXXXJ	CHIP C			
C117-120			CK73FF1E104Z	CHIP C	0.10UF Z		
C121			CK73FB1E103K	CHIP C	0.010UF K		
C122-124			CK73FF1E104Z	CHIP C	0.10UF Z		
C125			CE04EW1C100M	ELECTRO	10UF 16WV		
C126			CE04EW1E4R7M	ELECTRO	4.7UF 25WV		
C127			CK73FB1H102K	CHIP C	1000PF K		
C128			CE04EW1H2R2M	ELECTRO	2.2UF 50WV		
C129			CC73FSL1H101J	CHIP C	100PF J		
C130-137			CK73FF1E104Z	CHIP C	0.10UF Z		
C138			CC73FCH1H330J	CHIP C	33PF J		
C139 140			CK73FB1HXXXK	CHIP C			
C141			CE04EW1C100M	ELECTRO	10UF 16WV		
C142,143			CK73FF1E104Z	CHIP C	0.10UF Z		
C144			CC73FSL1H101J	CHIP C	100PF J		
C145			CE04EW1C100M	ELECTRO	10UF 16WV		
C146			CE04EW1H010M	ELECTRO	1.0UF 50WV		
C147			CE04EW1E4R7M	ELECTRO	4.7UF 25WV		
C148			CE04EW1C100M	ELECTRO	10UF 16WV		
C149			CC73FSL1H101J	CHIP C	100PF J		
C150			CK73FB1E223K	CHIP C	0.022UF K		
C151			CE04EW1C220M	ELECTRO	22UF 16WV		
C152,153			CE04EW1H010M	ELECTRO	1.0UF 50WV		
C154-155			CK73FB1HXXXK	CHIP C			
C156			CE04EW1C470M	ELECTRO	47UF 16WV		
C157			CE04EW1E4R7M	ELECTRO	4.7UF 25WV		
C158			CK73FB1E103K	CHIP C	0.010UF K		
C159			CE04EW1C100M	ELECTRO	10UF 16WV		
C160			CK73FB1H102K	CHIP C	1000PF K		
C161			CK73FF1E104Z	CHIP C	0.10UF Z		
C162			CC73FSL1H151J	CHIP C	150PF J		
C163			CK73FB1E103K	CHIP C	0.010UF K		
C164			CC73FSL1H151J	CHIP C	150PF J		
C165			CK73FF1E104Z	CHIP C	0.10UF Z		
C166			CK73FB1E103K	CHIP C	0.010UF K		
C167-174			CK73FF1EXXXZ	CHIP C			
C175			CK73FB2E103K	CHIP C	0.010UF K		
C176-177			CK73FB1HXXXK	CHIP C			
C178-181			CK73FF1E104Z	CHIP C	0.10UF Z		
C182			CC73FSL1H331J	CHIP C	330PF J		
C183			CK73FF1E104Z	CHIP C	0.10UF Z		
C184			CK73FB1E103K	CHIP C	0.010UF K		
C185			CC73FSL1H151J	CHIP C	150PF J		
C186-191			CK73FF1E104Z	CHIP C	0.10UF Z		
C192			CC73FCH1H150J	CHIP C	15PF J		
C193			CC73FSL1H561J	CHIP C	560PF J		
C194-198			CK73FF1E104Z	CHIP C	0.10UF Z		
C199-201			CK73FB1HXXXK	CHIP C			
C202-204			CK73FF1E104Z	CHIP C	0.10UF Z		
C205			CE04EW1H010M	ELECTRO	1.0UF 50WV		
C206			CK73FB1H102K	CHIP C	1000PF K		
C207			CK73FF1E104Z	CHIP C	0.10UF Z		
C208			CK73FB1H392K	CHIP C	3900PF K		
C209			CC73FSL1H121J	CHIP C	120PF J		

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C210			CK73FF1E104Z	CHIP C 0.1UF Z		
C211			CE04EW1H2R2M	ELECTRO 2.2UF 50WV		
C212			CE04EW1C330M	ELECTRO 33UF 16WV		
C213			CE04EW1HR22M	ELECTRO 0.22UF 50WV		
C214			CE04EW1H010M	ELECTRO 1.0UF 50WV		
C215 216			CK73FF1EXXXZ	CHIP C		
C217			CK4582M102K	CERAMIC 1000PF K		
C218			CE04NW1C100M	ELECTRO 10UF 16WV		
C219			CK45B1H472K	CERAMIC 4700PF K		
IC1			C05-0315-05	TRIMMING CAP 60PF		
CN1 ,2			E40-5038-05	FPC CONNECTOR(14P)		
CN3			E40-3239-05	PIN CONNECTOR(4P)		
CN4 5			E40-3237-05	PIN CONNECTOR(2P)		
CN6			E40-3239-05	PIN CONNECTOR(4P)		
CN7			E40-3240-05	PIN CONNECTOR(5P		
CN8			E40-3238-05	PIN CONNECTOR(3P)		
CN9			E40-5038-05	FPC CONNECTOR(14P)		
CN10			E40-5067-05	PIN CONNECTOR(10P)		
CN11			E40-3237-05	PIN CONNECTOR(2P)		
CN12			E40-3242-05	PIN CONNECTOR(7P)		
CN13			E40-3243-05	PIN CONNECTOR(8P)		
CN14			E40-5066-05	PIN CONNECTOR(9P)		
CN15			E40-3237-05	PIN CONNECTOR(2P)		
CN16			E40-3239-05	PIN CONNECTOR(4P)		
CN17			E40-3237-05	PIN CONNECTOR(2P)		
CN18			E40-3238-05	PIN CONNECTOR(3P)		
CN19-24			E40-5059-05	PIN CONNECTOR(5P)		
TP1			E23-0464-05	TERMINAL		
W1		*	E31-6079-05	CONNECTING WIRE		
			J32-0761-04	STUD		
CF1			L72-0319-05	CERAMIC FILTER(AM)		
CF2			L72-0315-05	CERAMIC FILTER(12K)		
CF3			L72-0319-05	CERAMIC FILTER(AM)		
CF4			L79-0446-05	CERAMIC DISCRI		
CF5			L72-0319-05	CERAMIC FILTER(AM)		
L1			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L2			L34-2121-05	TUNING COIL		
L3			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L4			L34-2124-05	TUNING COIL		
L5			L32-0650-15	OSCILLATING COIL		
L6			L34-2127-15	TUNING COIL		
L7			L34-2128-15	TUNING COIL		
L8			L40-2211-14	SMALL FIXED INDUCTOR(220UH)		
L9			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L10 -12			L34-2124-05	TUNING COIL		
L13 -15			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L16			L34-2124-05	TUNING COIL		
L17			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L18			L34-2124-05	TUNING COIL		
L19			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L20			L40-3325-04	SMALL FIXED INDUCTOR(3.3MH)		
L21			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L22			L34-2124-05	TUNING COIL		
L23			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		

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L24 ,25			L34 2124-05	TUNING COIL		
L26			L30-0199-05	IFT		
L27			L40-2215-25	SMALL FIXED INDUCTOR(220UH)		
L28			L30-0503-05	IFT		
R1 282			RK73FB2AXXXJ	CHIP R		
R283			RK73EB2B682J	CHIP R 6.8K J 1/8W		
VR1			R12-3126-05	TRIMMING POT.10K		
VR2			R12-3132-05	TRIMMING POT.47K		
VR3			R12-3128-05	TRIMMING POT.22K		
VR4			R12-3126-05	TRIMMING POT.10K		
VR5		*	R12-6018-05	TRIMMING POT.470K		
VR6 8			R12-3132-05	TRIMMING POT.47K		
VR9			R12-0104-05	TRIMMING POT.220		
VR10			R12-3130-05	TRIMMING POT.33K		
VR11			R12-3128-05	TRIMMING POT.22K		
W2			R92-0670-05	CHIP R 0 OHM		
W3			R92-0679-05	CHIP R 0 OHM		
W4			R92-1061-05	JUMPER REST 0 OHM		
W5			R92-0679-05	CHIP R 0 OHM		
D1 -14			RLS135	CHIP DIODE		
D15			1SV149A	DIODE		
D16 -19			1N60	DIODE		
D20		*	RLZ5.1A	CHIP ZENER DIODE(5.1V)		
D21 ,22			RLS73	CHIP DIODE		
D23			HSM88AS	CHIP DIODE		
D24			DAN202(K)	CHIP DIODE		
D25			RLZJ3.6B	CHIP ZENER DIODE(3.6V)		
D26 -30			RLS73	CHIP DIODE		
D31			HSM88AS	CHIP DIODE		
D32 -35			RLS73	CHIP DIODE		
D36 ,37			DAN202(K)	CHIP DIODE		
D38 ,39			RLS73	CHIP DIODE		
D40			DAN202(K)	CHIP DIODE		
D41			ND487R1-3R	DIODE		
D42			HSM88AS	CHIP DIODE		
D43 ,44			RLS73	CHIP DIODE		
D45 -48			RLS135	CHIP DIODE		
D49 -51			1N60	CHIP DIODE		
D52			RLS73	CHIP DIODE		
D53			DAN202(K)	CHIP DIODE		
D54 ,55			RLS73	CHIP DIODE		
D56			DAN202(K)	CHIP DIODE		
D57			RLZJ12B	ZENER DIODE(12V)		
D59			DAN202(K)	CHIP DIODE		
D60 64			RLS135	CHIP DIODE		
D65			RLS73	CHIP DIODE		
D66 ,67			HSM88AS	CHIP DIODE		
D68 -70		*	RLS73	CHIP DIODE		
D71			RLZJ9.1C	CHIP ZENER DIODE(9.1V)		
D72 ,73			RLS73	CHIP DIODE		
D74			1SS133	DIODE		
IC1			TC4066BF	IC(BILATERAL SWITCH X4)		
IC2			NJM2903M	IC(COMPARATOR X2)		
IC3			UPC1158H2	IC(ALC AMP)		

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IC4			TC4066BF	IC(BILATERAL SWITCH X4		
IC5			TA7302P	IC(FM IF)		
IC6 ,7			UPC577-	IC(FM IF AMP)		
IC8			TC9174F	IC(CMOS I/O)		
IC9			TA7..4CP	IC(OP AMP)		
IC10			TC4066BF	IC(BILATERAL SWITCH X4		
Q1 -4			3SK131(M)	CHIP FET		
Q5 -10			2SC2712(Y)	CHIP TRANSISTOR		
Q11		*	2SK210(Y)	CHIP FET		
Q12			2SC2712(Y)	CHIP TRANSISTOR		
Q13			2SA1162(Y)	CHIP TRANSISTOR		
Q14			3SK131(M)	CHIP FET		
Q15 ,16			2SC2712(Y)	CHIP TRANSISTOR		
Q17			2SK210(GR)	CHIP FET		
Q18			2SA1162(Y)	CHIP TRANSISTOR		
Q19 ,20			2SC2712(Y)	CHIP TRANSISTOR		
Q21			3SK131(M)	CHIP FET		
Q22			2SC2712(Y)	CHIP TRANSISTOR		
Q25 ,26			2SC2712(Y)	CHIP TRANSISTOR		
Q27			3SK131(M)	CHIP FET		
Q28 ,29			2SC2712(Y)	CHIP TRANSISTOR		
Q30			3SK131(M)	CHIP FET		
Q33 ,34			2SC2712(Y)	CHIP TRANSISTOR		
Q35 ,36			DTC124EK	DIGITAL TRANSISTOR		
Q37			DTA124EK	DIGITAL TRANSISTOR		
Q38			DTA114EK	DIGITAL TRANSISTOR		
Q39 ,40			DTC124EK	DIGITAL TRANSISTOR		
Q41 ,42			DTA124EK	DIGITAL TRANSISTOR		
Q43 -45			DTC124EK	DIGITAL TRANSISTOR		
Q46 49			DTA124EK	DIGITAL TRANSISTOR		
Q50 ,51			DTC124EK	DIGITAL TRANSISTOR		
Q52			DTA124EK	DIGITAL TRANSISTOR		
Q53 ,54			DTC124EK	DIGITAL TRANSISTOR		
Q55 ,56			DTA124EK	DIGITAL TRANSISTOR		
Q57			DTC124EK	DIGITAL TRANSISTOR		
Q58			DTA124EK	DIGITAL TRANSISTOR		
Q59			DTC124EK	DIGITAL TRANSISTOR		
Q60 -63			DTA124EK	DIGITAL TRANSISTOR		
Q64			DTC124EK	DIGITAL TRANSISTOR		
Q65			DTA124EK	DIGITAL TRANSISTOR		
Q66 ,67			DTC124EK	DIGITAL TRANSISTOR		
TH1 ,2			112-502-2	THERMISTOR 5K		
TH3			112-503-2	THERMISTOR 50K		
TH4			112-101 2	THERMISTOR 100		
TH5			112-103-2	THERMISTOR 10K		
TH6			112-302-2	THERMISTOR 3K		
VCO2 (X58-3390-03)						
C1			CK73FB1H102K	CHIP C 1000PF K		
C2			CC73FSL1H101J	CHIP C 100PF J		
C3 -7			CC73FCH1HXXXD	CHIP C		
C8 ,9			CK73FB1H102K	CHIP C 1000PF K		
C10			CC73FCH1H010C	CHIP C 1PF C		
C11			CK73FB1H102K	CHIP C 1000PF K		
TC1			C05-0349-05	TRIMMING CAP 10PF		

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			B42-2437-04	LABEL		
Q1			2SK508NV(K52)	CHIP FET		
Q2			2SC2714(Y)	CHIP TRANSISTOR		
L1			L34-0690-05	CHOKE COIL 3.3UH		
L2			L34-2353-05	COIL		
D1			1SV164	VARI-CAP DIODE		
VCO (X58-3630-XX)						
C1			CK73FB1H102K	CHIP C 1000PF K	AF	
C1			CK73FB1E103K	CHIP C 0.010UF K	PLL	
C2 -6			CC73FCH1HXXXJ	CHIP C		
C7 ,8			CK73FB1H102K	CHIP C 1000PF K	AF	
C7 ,8			CK73FB1E103K	CHIP C 0.010UF K	PLL	
C9 -13			CC73FCH1HXXXJ	CHIP C		
C14 ,15			CK73FB1H102K	CHIP C 1000PF K	AF	
C14 ,15			CK73FB1E103K	CHIP C 0.010UF K	PLL	
C16 -20			CC73FCH1HXXXJ	CHIP C		
C21 ,22			CK73FB1H102K	CHIP C 1000PF K	AF	
C21 ,22			CK73FB1E103K	CHIP C 0.010UF K	PLL	
C23 -27			CC73FCH1HXXXJ	CHIP C		
C28			CK73FB1H102K	CHIP C 1000PF K	AF	
C28			CK73FB1E103K	CHIP C 0.010UF K	PLL	
C29 ,30			C91-0119-05	CERAMIC 0.047UF K		
TC1 ,2			C05-0349-05	TRIMMING CAP 10PF		
TC3 ,4			C05-0348-05	TRIMMING CAP 6PF	AF	
TC3 ,4		*	C05-0439-05	TRIMMING CAP 10PF	PLL	
W1			E40-5158-05	PIN CONNECTOR 4P		
W2			E40-5159-05	PIN CONNECTOR 7P		
A1		*	F11-1140-04	SHIELDING COVER		
A2		*	F11-1141-04	SHIELDING COVER		
L1			L33-0664-05	CHOKE COIL 2.7UH		
L2		*	L34-2354-05	COIL (VCO)	AF	
L2		*	L34-2355-05	COIL (VCO)	PLL	
L3			L40-4791-19	SMALL FIXED INDUCTOR 4.7UH		
L4			L33-0664-05	CHOKE COIL 2.7UH		
L5		*	L34-2354-05	COIL (VCO)	AF	
L5		*	L34-2355-05	COIL (VCO)	PLL	
L6			L40-4791-19	SMALL FIXED INDUCTOR 4.7UH		
L7			L33-0664-05	CHOKE COIL 2.7UH		
L8		*	L34-2354-05	COIL (VCO)	AF	
L8		*	L34-2356-05	COIL (VCO)	PLL	
L9			L40-4791-19	SMALL FIXED INDUCTOR 4.7UH		
L10			L33-0664-05	CHOKE COIL 2.7UH		
L11		*	L34-2354-05	COIL (VCO)	AF	
L11		*	L34-2357-05	COIL (VCO)	PLL	
L12			L40-4791-19	SMALL FIXED INDUCTOR 4.7UH		
			N30-2604-41	PAN HEAD MACHINE SCREW		
R1 -20			RK73FB2AXXXJ	CHIP R		
W3 ,4			R92-0670-05	CHIP R 0 OHM		
D1			1SV166	CHIP DIODE		

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D2			RLS135	CHIP DIODE		
D3			1SV166	CHIP DIODE		
D4			RLS135	CHIP DIODE		
D5			1SV166	CHIP DIODE		
D6			RLS135	CHIP DIODE		
D7			1SV166	CHIP DIODE		
D8			RLS135	CHIP DIODE		
Q1 -4			2SK210(GR)	CHIP FET		

VOX (X59-1080-01)

Ref. No.	Address	New Parts	Parts No.	Description	Destination	Remarks
C2			CK73FB1E223K	CHIP C 0.022UF K		
C1			CK73FB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
R2 -3			RK73FB2AXXXJ	CHIP R		
W1 3			R92-0670-05	CHIP R 0 OHM		
D1 ,2			DAP202(K)	CHIP DIODE		
IC1			NJM2904M	IC(OP AMP X2)		
IC2			TC4001BF	IC(NOR X6)		
Q1			2SC2712(Y)	CHIP TRANSISTOR		

FM MIC AMP (X59-3000-03)

Ref. No.	Address	New Parts	Parts No.	Description	Destination	Remarks
C1 -3			CC73FCH1HXXXJ	CHIP C		
C4			CK73FB1H102K	CHIP C 1000PF K		
C5			CK73FB1E223K	CHIP C 0.022UF K		
C2			CK73FB1H561K	CHIP C 560PF K		
			E23-0471-05	TERMINAL		
R1 -2			RK73FB2AXXXJ	CHIP R		
J1			R92-0670-05	CHIP R 0 OHM		
IC1			NJM4558M	IC(OP AMP X2)		
Q1			2SC2712(Y)	CHIP TRANSISTOR		

NB2 (X59-3350-00)

Ref. No.	Address	New Parts	Parts No.	Description	Destination	Remarks
C3			CK73EF1E474Z	CHIP C 0.47UF Z		
C2 1			CK73FB1HXXXK	CHIP C		
			E23-0471-05	TERMINAL		
R1 -3			RK73FB2AXXXJ	CHIP R		
W1 -3			R92-0670-05	CHIP R 0 OHM		
Q1			DTC114EK	DIGITAL TRANSISTOR		
IC1			TC4011BF	IC(NAND X4)		

VCO1 (X59-3440-00)

Ref. No.	Address	New Parts	Parts No.	Description	Destination	Remarks
C1			CC73FCH1H080D	CHIP C 8.0PF D		
C2			CK73FB1H102K	CHIP C 1000PF K		
C3			CC73FCH1H030C	CHIP C 3.0PF C		
C4			CK73FB1H103K	CHIP C 0.010UF K		
			E23-0471-05	TERMINAL		
L1			L40-1011-48	SMALL FIXED INDUCTOR		
R1 -7			RK73FB2AXXXJ	CHIP R		
Q1			2SK210(GR)	CHIP FET		
Q2			2SC2714(Y)	CHIP TRANSISTOR		

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			LPF (X59-3450-XX)			
C1			CK73FB1H103K	CHIP C 0.010UF K		
			E23-0471-05	TERMINAL		
R1 -4			RK73FB2AXXXJ	CHIP R		
Q1 -3		*	2SC3324(G)	CHIP TRANSISTOR		
			MKR (X59-3640-00)			
C2			CC73FCH1H100D	CHIP C 10PF D		
C3 ,4			CK73FF1E104Z	CHIP C 0.10UF Z		
			E23-0471-05	TERMINAL		
R1 -5			RK73FB2AXXXJ	CHIP R		
W1 ,2			R92-0670-05	CHIP R 0 OHM		
D1			DA204K	CHIP DIODE		
D2			RLS73	CHIP DIODE		
IC1		*	TC4013BF	IC(D FLIP-FLOP X2)		
			SFT (X59-3650-00)			
			E23-0471-05	TERMINAL		
W1 -3			R92-0670-05	CHIP R 0 OHM		
D1 -5			DAN202(K)	CHIP DIODE		
D7			DAP202(K)	CHIP DIODE		
D6			RLS73	CHIP DIODE		
D8 ,9			RLS73	CHIP DIODE		
			CWT (X59-3660-00)			
C201			CK73FB1E473M	CHIP C 0.047UF M		
C202			CK73FF1E104Z	CHIP C 0.10UF Z		
			E23-0471-05	TERMINAL		
R201-206			RK73FB2AXXXJ	CHIP R		
W201,202			R92-0670-05	CHIP R 0 OHM		
D201,202			RLS73	CHIP DIODE		
D203		*	RLZJ3.6B	CHIP ZENER DIODE(3.6V)		
D204		*	RLZJ4.7B	CHIP ZENER DIODE(4.7V)		
Q201			2SA1162(Y)	CHIP TRANSISTOR		
Q202			DTA144EK	DIGITAL TRANSISTOR		
Q203,204			DTC144EK	DIGITAL TRANSISTOR		
Q205			DTA144EK	DIGITAL TRANSISTOR		
Q206			DTC144EK	DIGITAL TRANSISTOR		
Q207			DTA144EK	DIGITAL TRANSISTOR		
Q208			DTC114TK	DIGITAL TRANSISTOR		
			MAP (X59-3670-00)			
C301			CK73FB1E473M	CHIP C 0.047UF M		
			E23-0471-05	TERMINAL		
R301-310			RK73FB2AXXXJ	CHIP R		
IC301			NJM4558M	IC(OP AMP X2)		
			TRX (X59-3680-00)			
			E23-0471-05	TERMINAL		

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R[illegible]			RK73FB2AXXXJ	CHIP R		
Q151,152			2SA1204(Y)	CHIP TRANSISTOR		
Q153,155			DTC124TK	DIGITAL TRANSISTOR		
ALC (X59-3700-00)						
C251			CK73FB1E473M	CHIP C 0.047UF M		
C252-253			CK73FB1HXXXK	CHIP C		
			E23-0471-05	TERMINAL		
R251-257			RK73FB2AXXXJ	CHIP R		
R258			R92-0670-05	CHIP R 0 OHM		
D251			RLS73	CHIP DIODE		
D252		*	RLZJ12B	CHIP ZENER DIODE 12V		
Q251			2SC2712(Y)	CHIP TRANSISTOR		
Q252			DTC144EK	DIGITAL TRANSISTOR		
Q253			DTA144EK	DIGITAL TRANSISTOR		
Q254,255			DTC144EK	DIGITAL TRANSISTOR		
MIC AMP (X59-3710-00)						
C251			CK73FF1H103Z	CHIP C 0.010UF Z		
C252			CC73FCH1H101J	CHIP C 100PF J		
C253			CK73EF1C105Z	CHIP C 1.0UF Z		
C254			CC73FCH1H101J	CHIP C 100PF J		
C255			CK73FB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
R251-259			RK73FB2AXXXJ	CHIP R		
R260,261			R92-0670-05	CHIP R 0 OHM		
D251			DAN202(K)	CHIP DIODE		
Q251			2SC3324(G)	CHIP TRANSISTOR		
Q252,253			DTA114EK	DIGITAL TRANSISTOR		
Q254			DTC114TK	DIGITAL TRANSISTOR		
Q255			DTC114EK	DIGITAL TRANSISTOR		
FILTER UNIT (X51-3070-00) : SD						
C1 ,2			CK45F1H103Z	CERAMIC 0.010UF Z		
CN1 ,2			E40-0517-05	PIN CONNECTOR		
XF1			L71-0292-05	CRYSTAL FILTER(YG-455S-1)		
FILTER UNIT (X51-3080-00) : SD						
C1 ,2			CK45F1H103Z	CERAMIC 0.010UF Z		
CN1 ,2			E40-0517-05	PIN CONNECTOR		
XF1			L71-0239-25	CRYSTAL FILTER(YG-455-CN.)		
DSP UNIT (X53-3260-00) : SD						
		*	B42-3377-04	LABEL		
C1 ,2			CE04EW1E331M	ERECTRO 330UF 25WV		
C3 ,4			CK73FB1E223K	CHIP C 0.022UF K		
C5 ,6			CK73FB1H102K	CHIP C 1000PF K		
C7 ,8			CK73EF1E474Z	CHIP C 0.47UF Z		
C9 -16			CE04EW1E220M	ERECTRO 22UF 25WV		
C17			C90-2045-05	ERECTRO 2.2UF 25WV		
C18 ,19			CE04EW1E220M	ERECTRO 22UF 25WV		

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Ref No. 参照番号	Address 位置	New Parts 新	Parts No 部品番号	Description 部品名／規格		Destination 仕向	Remarks 備考
C20 -22			CK73FB1E223K	CHIP C	0.022UF	K	
C23			CE04EW1E220M	ERECTRO	22UF	25WV	
C24			C90-2045-05	ERECTRO	2.2UF	25WV	
C25			CE04EW1E220M	ERECTRO	22UF	25WV	
C26			C90-2045-05	ERECTRO	2.2UF	25WV	
C27 ,28			CE04EW1E101M	ERECTRO	100UF	25WV	
C29 -30			CK73FB1HXXXK	CHIP C			
C31 ,32			C90-2045-05	ERECTRO	2.2UF	25WV	
C33 -36			CK73FB1E223K	CHIP C	0.022UF	K	
C40 ,41			CC73FSL1H101J	CHIP C	100PF	J	
C42 -45			CK73EB1E683K	CHIP C	0.068UF	K	
C46 -50			CC73ECH1H202J	CHIP C	2000PF	J	
C51 ,52			CC73FSL1H221J	CHIP C	220PF	J	
C53			CC73FCH1H102J	CHIP C	1000PF	J	
C54			C92-0004-05	CHIP-TAN	1UF	16WV	
C55			CE04EW1H3R3M	ERECTRO	3.3UF	50WV	
C56			C90-2040-05	ERECTRO	2.2UF	25WV	
C57			CE04EW1H3R3M	ERECTRO	3.3UF	50WV	
C58			C92-0004-05	CHIP-TAN	1UF	16WV	
C59 -63			CC73FSL1HXXXJ	CHIP C			
C64			CK73FB1H153K	CHIP C	0.015UF	K	
C65 ,66			CK73FB1E223K	CHIP C	0.022UF	K	
C67			CC73FSL1H101J	CHIP C	100PF	J	
C68 -73			CK73FB1E223K	CHIP C	0.022UF	K	
C74 -75			CC73FSL1HXXXJ	CHIP C			
C76			CC73FCH1H102J	CHIP C	1000PF	J	
C77			CK73FB1E223K	CHIP C	0.022UF	K	
C78			C92-0004-05	CHIP-TAN	1UF	16WV	
C90 ,91			CK73FB1H102K	CHIP C	1000PF	K	
C92			CK73FB1E223K	CHIP C	0.022UF	K	
C93 -96			CC73FSL1H101J	CHIP C	100PF	J	
C200			CE04EW1A221M	ELECTRO	220UF	10WV	
C201			CK73FB1E223K	CHIP C	0.022UF	K	
C202-208			CC73FSL1H101J	CHIP C	100PF	J	
C209			CK73FF1E104Z	CHIP C	0.1UF	Z	
C210			CK73EB1E563K	CHIP C	0.056UF	K	
C211			CK73FB1H102K	CHIP C	1000PF	K	
C212,213			CC73FCH1H100D	CHIP C	10PF	D	
C214-222			CK73FB1H221K	CHIP C	220PF	K	
C224			CK73FF1E104Z	CHIP C	0.10UF	Z	
C225-228			CK73FB1E223K	CHIP C	0.022UF	K	
C229			CE04EW1C470M	ELECTRO	47UF	16WV	
C230,231			CK73FB1E223K	CHIP C	0.022UF	K	
C232-234			CC73FSL1H101J	CHIP C	100PF	J	
C235,236			CK73FB1H102K	CHIP C	1000PF	K	
C237			CK73FB1E223K	CHIP C	0.022UF	K	
C238			CK73FF1E104Z	CHIP C	0.10UF	Z	
C239			CE04EW1E101M	ELECTRO	100UF	M	
C240			CK73EB1E683K	CHIP C	0.068	M	
C241			CK73FB1H153K	CHIP C	0.015UF	M	
C242			CE04EW1C470M	CHIP C	47UF	16WV	
C243			CK73EB1E563K	CHIP C	0.056UF	K	
C244			CK73FB1H562K	CHIP C	5600PF	K	
C245			CE04EW1C470M	ELECTRO	47UF	16WV	
C246			CK73FB1H102K	CHIP C	1000PF	K	

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C247-249			CC73FCH1HXXXJ	CHIP C				
C250			CC73FSL1H470J	CHIP C	47PF	J		
C251			CC73FCH1H030C	CHIP C	3.0PF	C		
C252-254			CK73FB1HXXXK	CHIP C				
C255			CE04EW1E101M	ELECTRO	100UF	25WV		
C256			CK73FB1H153K	CHIP C	0.015UF	K		
C257			CE04EW1C470M	ELECTRO	47UF	16WV		
C258-263			CK73FB1HXXXK	CHIP C				
C264,265			CC73FSL1H101J	CHIP C	100PF	J		
C266			CK73FB1H221K	CHIP C	220PF	K		
C267-271			CC73FSL1H101J	CHIP C	100PF	J		
		*	E31-6066-05	CONNECTING WIRE				
			E31-6078-05	CONNECTING WIRE				
CN1			E40-3243-05	PIN CONNECTOR(8P)				
CN2			E40-3239-05	PIN CONNECTOR(4P)				
CN3			E40-3237-05	PIN CONNECTOR(2P)				
CN4 ,5			E40-5135-05	PIN CONNECTOR(20P)				
CN6			E40-5066-05	PIN CONNECTOR(9P)				
CN7			E40-3243-05	PIN CONNECTOR(8P)				
CN8			E02-2018-05	IC SOCKET(40P)				
TP1 -3			E23-0464-05	TERMINAL				
TP5			E40-0211-05	PIN CONNECTOR				
TP6			E23-0464-05	TERMINAL				
301	3B		F01-0972-02	HEAT SINK				
302	3B	*	F10-1405-03	SHIELDING PLATE				
303	3B		G02-0574-04	FLAT SPRING				
304	3B		J21-4280-04	MOUNTING HARDWARE				
CF1		*	L72-0375-05	CERAMIC FILTER				
L1 ,2		*	L40-1035-29	SMALL FIXED INDUCTOR(10MH)				
L3		*	L40-1225-29	SMALL FIXED INDUCTOR(1200UH)				
L10			L40-1001-48	SMALL FIXED INDUCTOR(10UH)				
L11			L40-1011-48	SMALL FIXED INDUCTOR(100UH)				
L12			L32-0198-05	OSCILLATING COIL(VCO)				
L13			L40-1011-48	SMALL FIXED INDUCTOR(100UH)				
X1		*	L77-1408-05	CRYSTAL RESONATOR(25MHZ)				
Y	3B		N30-2606-46	PAN HEAD MACHINE SCREW				
J	3B		N87-2606-46	BRAZIER HEAD TAPTITE SCREW				
R1 -236			RK73FB2AXXXJ	CHIP R	1			
VR1			R12-3126-05	TRIMMING POT.10K				
S1 ,2		*	S59-0439-05	DIP SWITCH				
S3		*	S59-4401-05	DIP SWITCH				
IC15			UPC78M05HF	IC				
IC16			UPC79M05HF	IC				
IC32			UPD65012GF-350	IC				
D1			RD3.9M-B2	CHIP ZENER DIODE(3.9V)				
D2			1SS226	CHIP DIODE				

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D3			1SS272	DIODE		
D4			1SV166	DIODE		
IC1 ,2		*	MC74HC4052F	IC		
IC3		*	MC74HC4053F	IC		
IC4 ,5			NJM4558M	IC(OP AMP X2)		
IC6			NJM4560M	IC(OP AMP X2)		
IC7 -9			NJM4558M	IC(OP AMP X2		
IC10 ,11		*	NJM072BM	IC		
IC12		*	PCM78AP	IC		
IC13		*	MM74HC100M	IC		
IC14			TC74HC74AF	IC		
IC17		*	PCM56P	IC(DA CONVERTER)		
IC18		*	MC74HC4053F	IC		
IC19		*	LM6361M	IC		
IC20			NJM4558M	IC(OP AMP X2)		
IC21		*	MC74HC4053F	IC		
IC31		*	TMS320E15JJBC1	IC		
IC33			S-8054ALR-LN	IC(VOLTAGE DETECTOR)		
IC34			CX-7925B	IC(DIGITAL SELECT PLL)		
IC35			NJM78L08UA	IC(VOLTAGE REGULATOR/+8V)		
IC36		*	MM74HCT00M	IC		
Q1			2SK508(K53)	CHIP FET		
Q2 -6			2SC2412K(R)	CHIP TRANSISTOR		
Q11			DTC144WK	DIGITAL TRANSISTOR		
Q12			2SC2714(Y)	CHIP TRANSISTOR		
Q13			2SK210(GR)	CHIP FET		
Q14 -16			2SC2714	CHIP TRANSISTOR		
Q17 19			2SC3324(G)	CHIP TRANSISTOR		

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U: PX(Far East, Hawaii) T: England M: Other Areas
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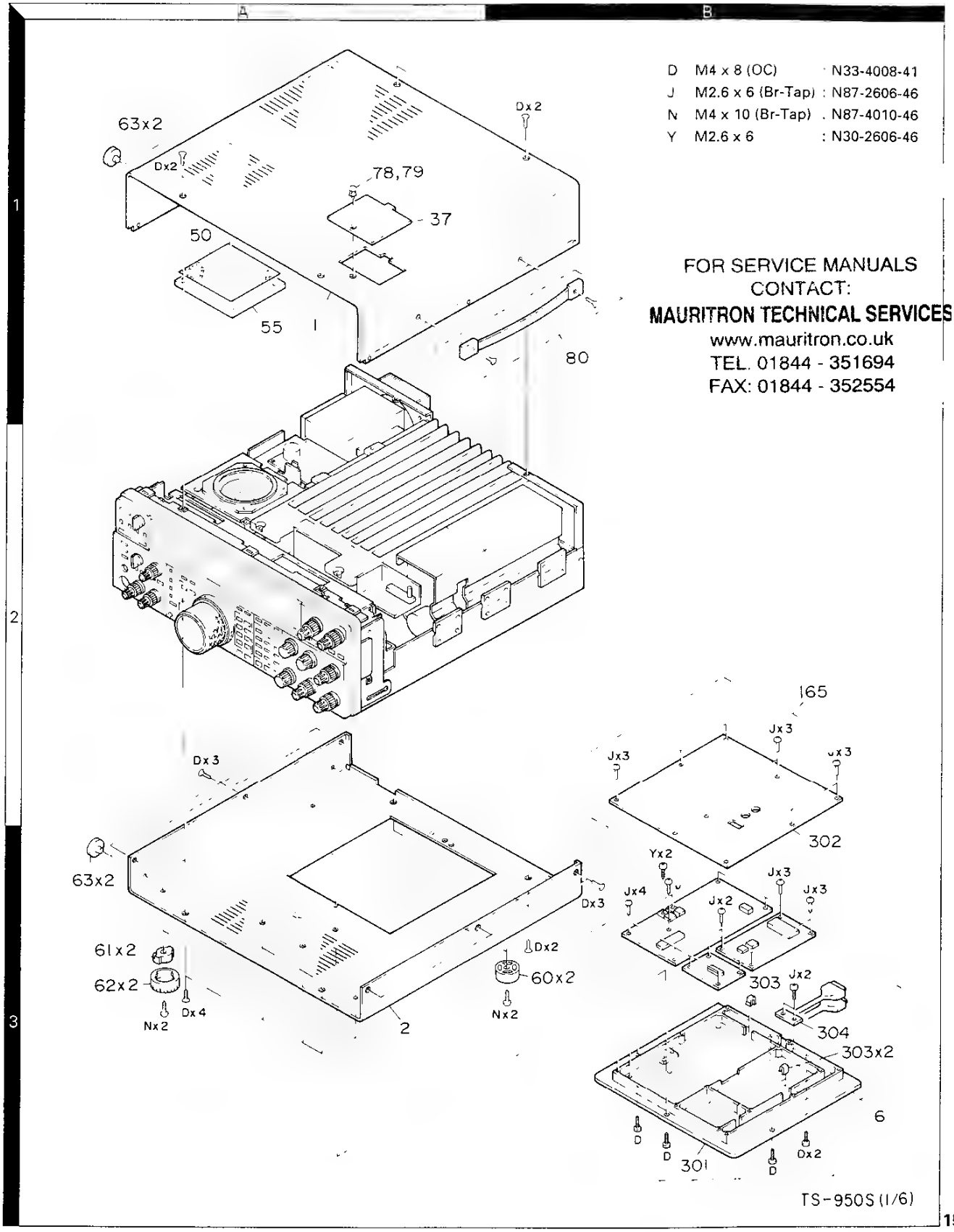
DISASSEMBLY



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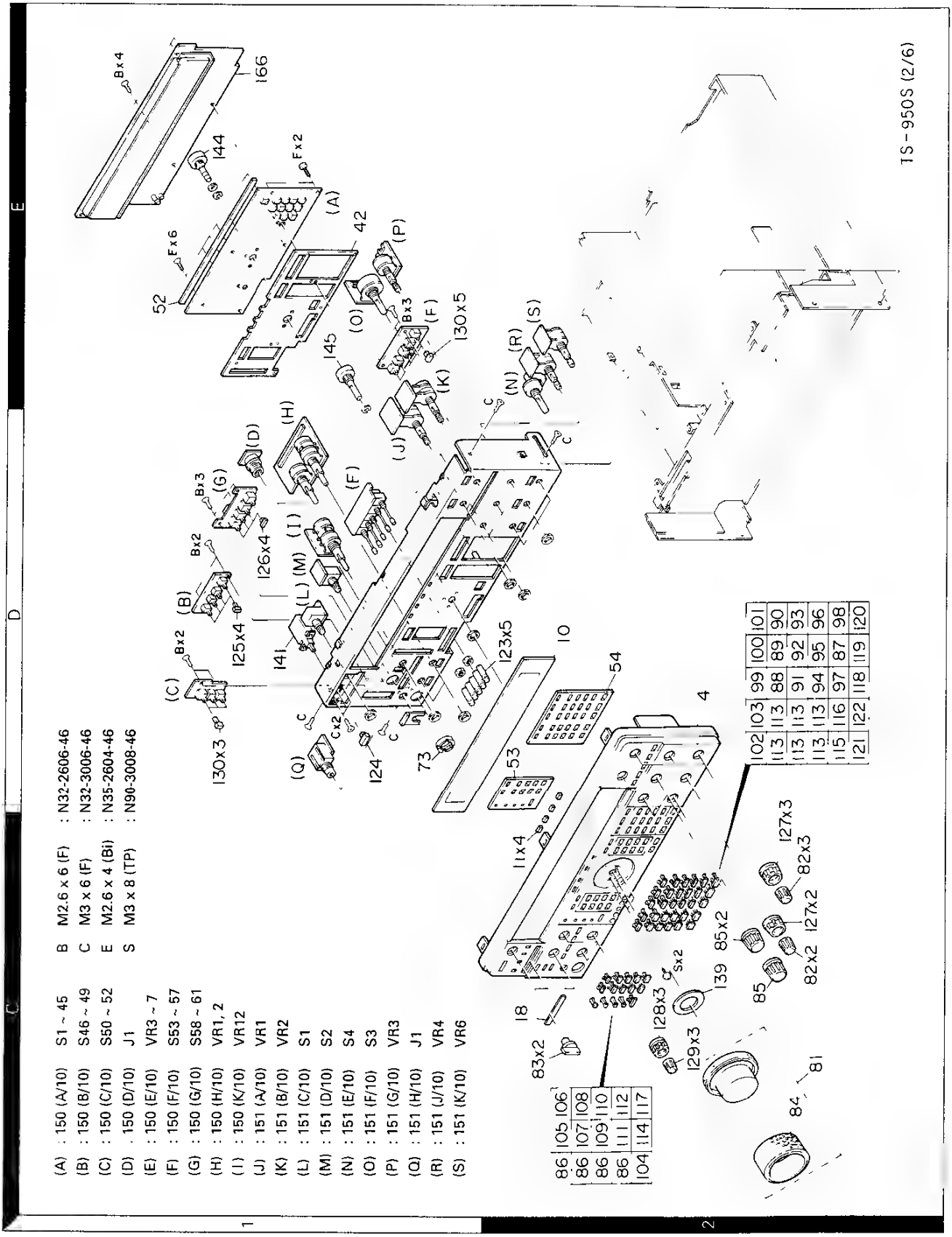
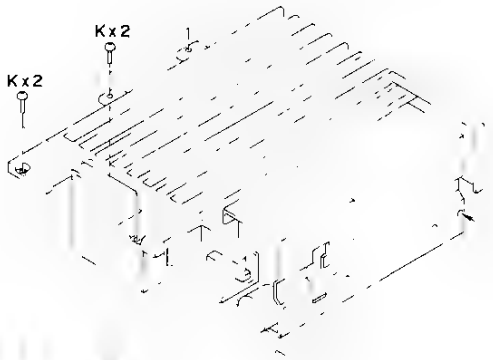
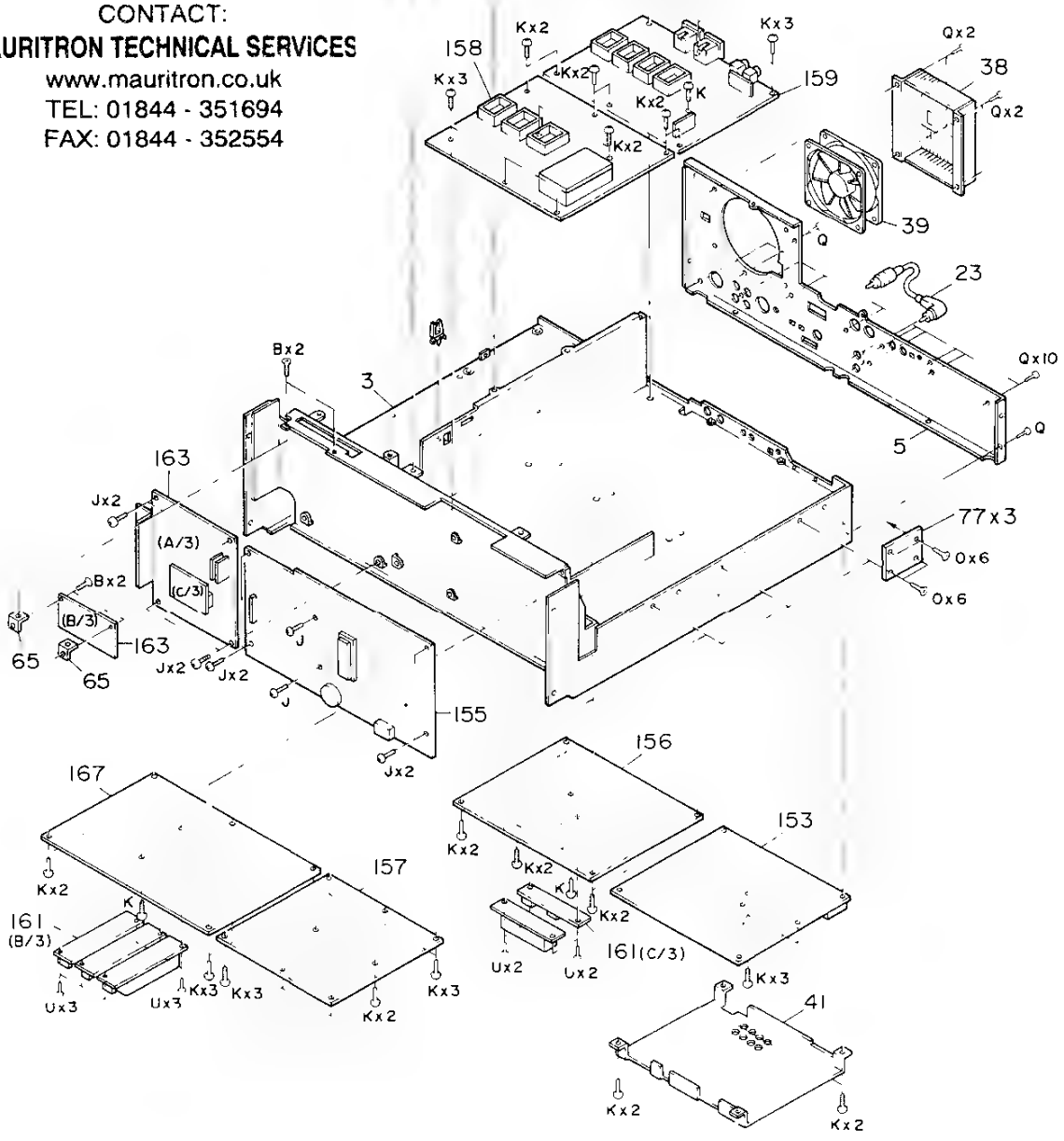


DISASSEMBLY

B	M2.6 x 6 (F)	: N32-2606-46
J	M2.6 x 6 (Br Tap)	: N87-2606-46
K	M3 x 6 (Br-Tap)	: N87-3006-46
O	M3 x 6 (F-Tap)	: N88-3006-46
Q	M3 x 8 (Bi-Tap) BLK	: N89-3008-45
U	M3 x 10	: N30-3010-46

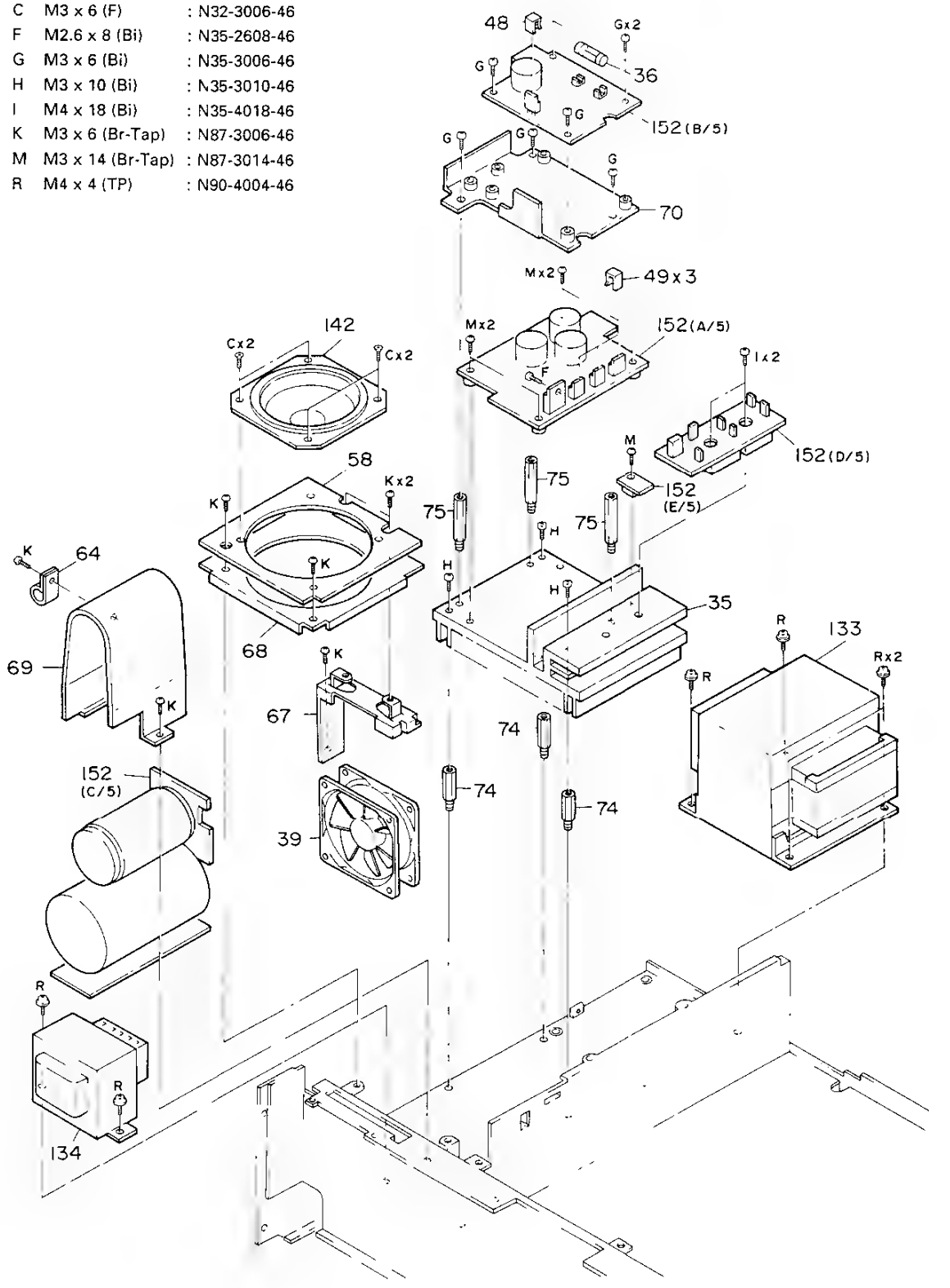




TS-950S(3/6)

DISASSEMBLY

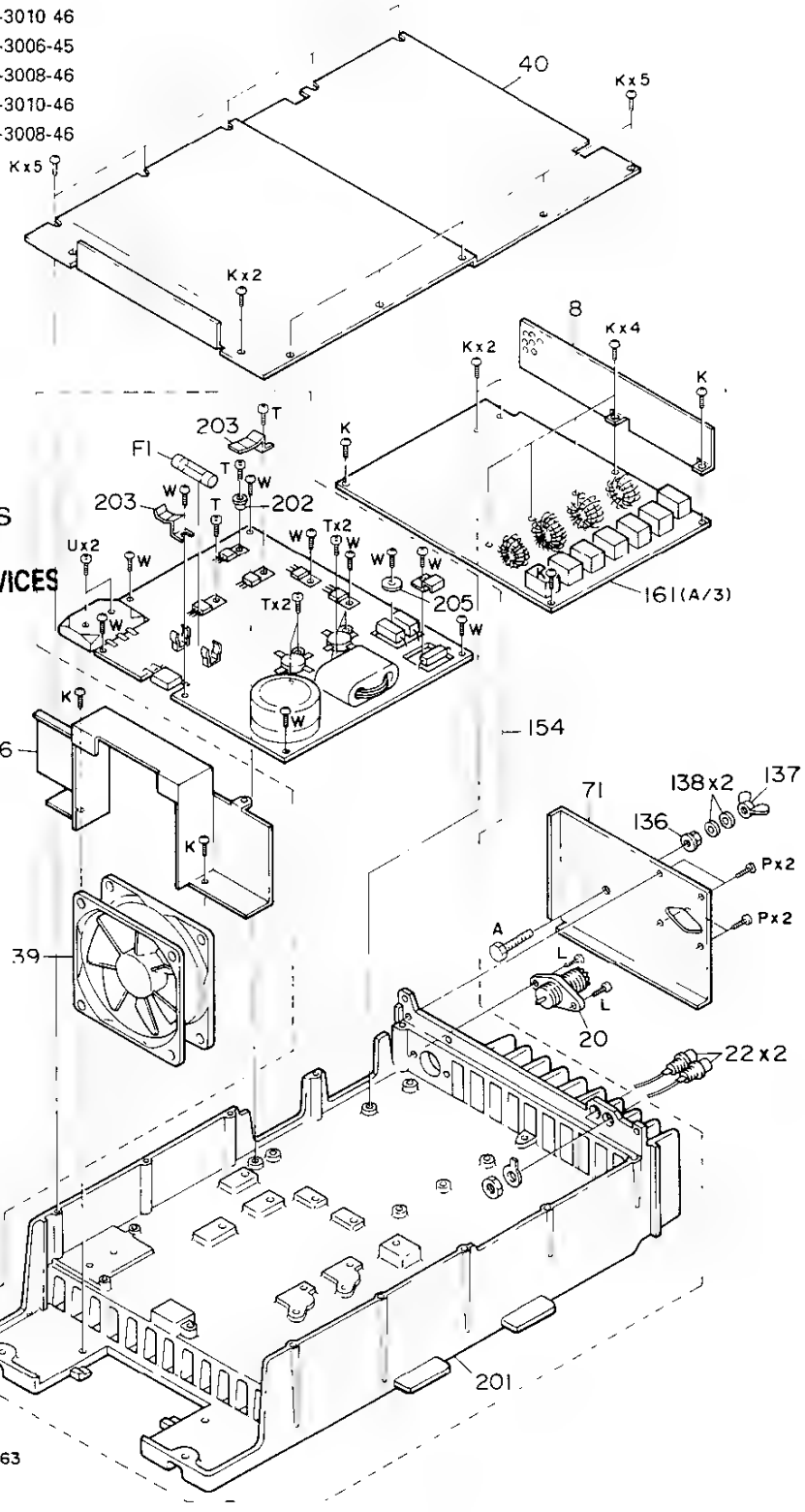
C	M3 x 6 (F)	: N32-3006-46
F	M2.6 x 8 (Bi)	: N35-2608-46
G	M3 x 6 (Bi)	: N35-3006-46
H	M3 x 10 (Bi)	: N35-3010-46
I	M4 x 18 (Bi)	: N35-4018-46
K	M3 x 6 (Br-Tap)	: N87-3006-46
M	M3 x 14 (Br-Tap)	: N87-3014-46
R	M4 x 4 (TP)	: N90-4004-46



TS-950S(4/6)

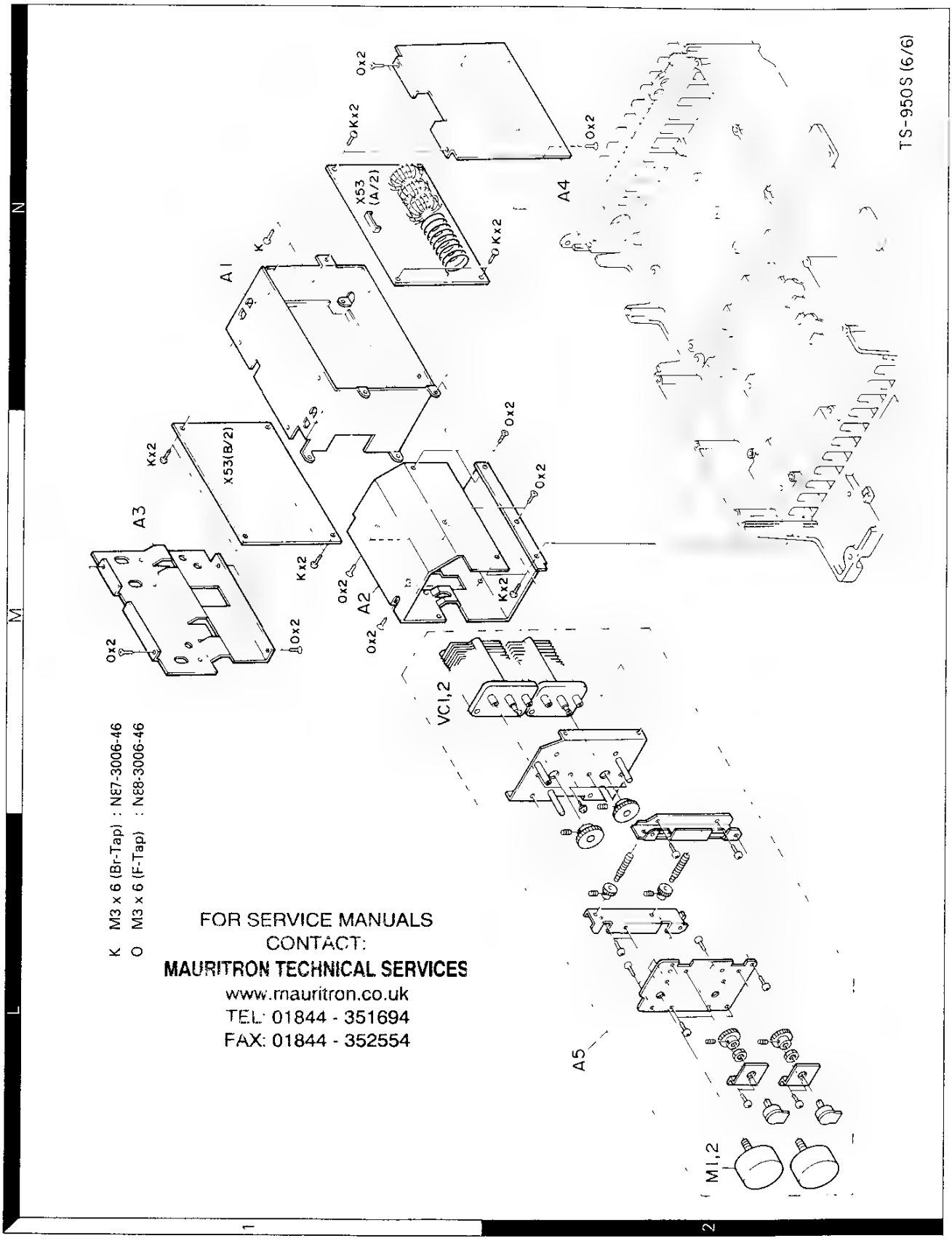
DISASSEMBLY

A	M4 x 16	. N09-0682-04
K	M3 x 6 (Br-Tap)	: N87-3006-46
L	M3 x 10 (Br-Tap)	: N87-3010 46
P	M3 x 6 (Bi-Tap) BLK	: N89-3006-45
T	M3 x 8	: N30-3008-46
U	M3 x 10	: N30-3010-46
W	M3 x 8 (Br-Tap)	. N87-3008-46

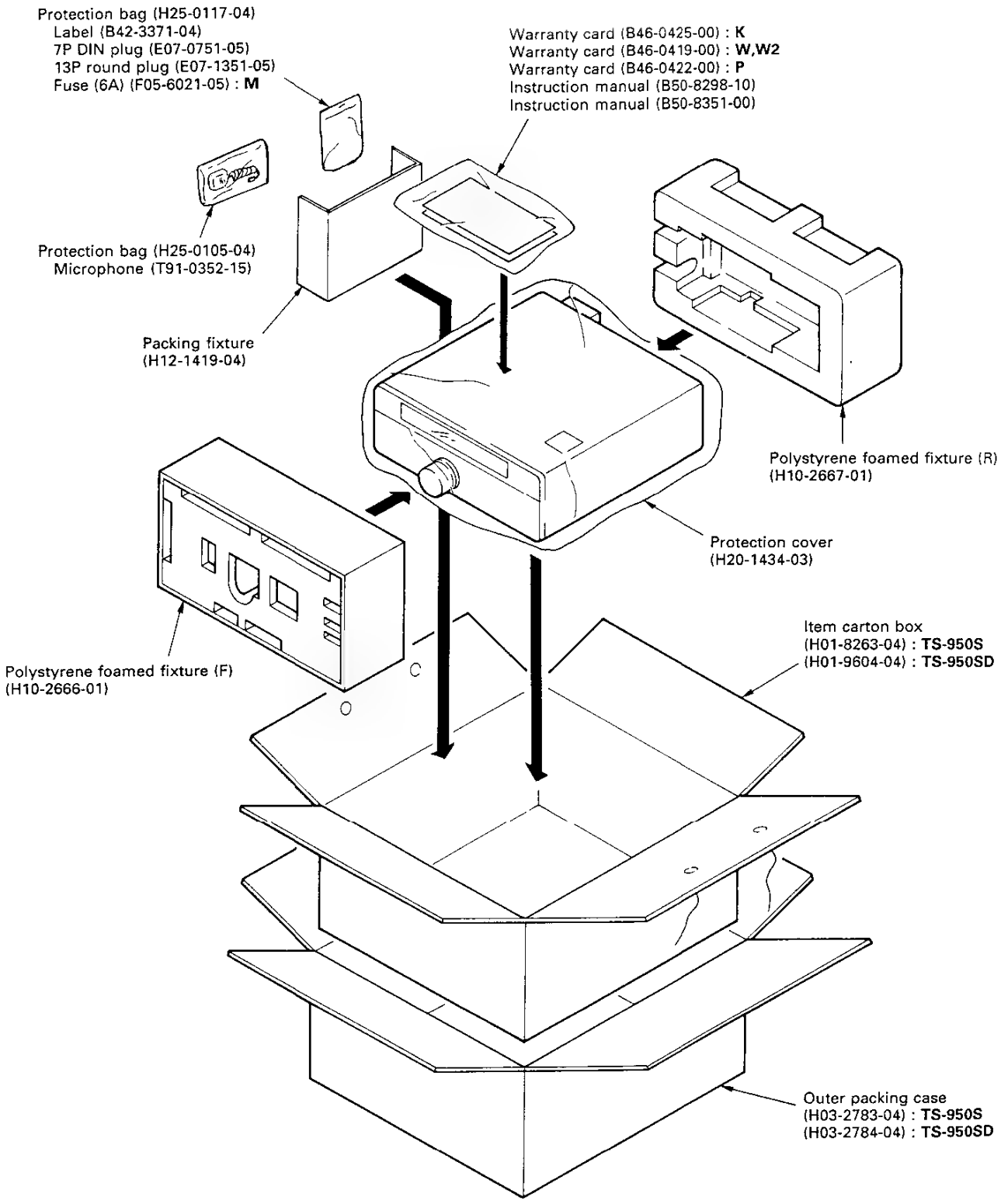


TS-950S(5/6)

DISASSEMBLY



PACKING


Protection bag (H25-0117-04)
Label (B42-3371-04)
7P DIN plug (E07-0751-05)
13P round plug (E07-1351-05)
Fuse (6A) (F05-6021-05) : M
Warranty card (B46-0425-00) : K
Warranty card (B46-0419-00) : W,W2
Warranty card (B46-0422-00) : P
Instruction manual (B50-8298-10)
Instruction manual (B50-8351-00)
Protection bag (H25-0105-04)
Microphone (T91-0352-15)
Packing fixture
(H12-1419-04)
Polystyrene foamed fixture (R)
(H10-2667-01)
Protection cover
(H20-1434-03)
Item carton box
(H01-8263-04) : TS-950S
(H01-9604-04) : TS-950SD
Polystyrene foamed fixture (F)
(H10-2666-01)
Outer packing case
(H03-2783-04) : TS-950S
(H03-2784-04) : TS-950SD

ADJUSTMENT

Required Test Equipment

1. DC Voltmeter (DC V.M)
1) Input resistance : More than 1MΩ
2) Voltage range : 1.5 to 1000V AC/DC
Note : A high-precision multimeter may be used. However, accurate readings can not be obtained for high-impedance circuits.

2. DC Ammeter
1) Current range : 100mA, 1.5A, 15A, High-precision ammeter may be used.

3. RF VTVM (RF V.M)
1) Input impedance : 1MΩ and less than 3pF, min
2) Voltage range : 10mV to 300V
3) Frequency range : 10kHz to 500MHz

4. AF Voltmeter (AF V.M)
1) Frequency range : 50Hz to 10kHz
2) Input resistance : 1MΩ or greater
3) Voltage range : 10mV to 30V

5. AF Generator (AG)
1) Frequency range : 200Hz to 5kHz
2) Output : 1mV or less to 1V, low distortion

6. AF Dummy Load
1) Impedance : 8Ω
2) Dissipation : 3W or greater

7. Oscilloscope
Requires high sensitivity, and external synchronization capability (150MHz or greater).

8. Sweep Generator
1) Center frequency : 50kHz to 90MHz
2) Frequency deviation : Maximum ±35MHz
3) Output voltage : 0.1V or greater
4) Sweep rate : At least 0.5 sec/cm

9. Standard Signal Generator (SSG)
1) Frequency range : 50kHz to 50MHz
2) Output : -20dB/0.1μV to 120dB/1V
3) Output impedance : 50Ω
4) AM and FM modulation can be possible.
Note : Generator must be frequency stable

10. Frequency Counter (f. counter)
1) Minimum input voltage : 50mV
2) Frequency range : 150MHz or greater

11. Noise Generator
Must generate ignition noise containing harmonics beyond 30MHz

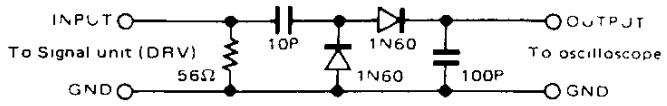
12. RF Dummy Load
1) Impedance : 150Ω and 50Ω
2) Dissipation : 150W or greater

13. Linear Detector
1) Frequency range : 30MHz

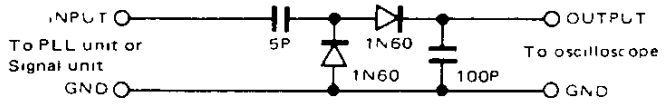
14. Power Meter
1) Impedance : 50Ω
2) Dissipation 300W continuous or greater
3) Frequency limits : 60MHz or greater

15. Spectrum Analyzer
1) Frequency range : 100kHz to 110MHz or greater
2) Bandwidth : 1kHz to 3MHz .

16. Detector
1) For adjustment of TX BPF



2) For adjustment of PLL/VCO BPF



17. Directional Coupler

18. Monitor Receiver
R-1000 class

19. Microphone
MC-43S or MC-60/60S8

20. Tracking Generator

ADJUSTMENT

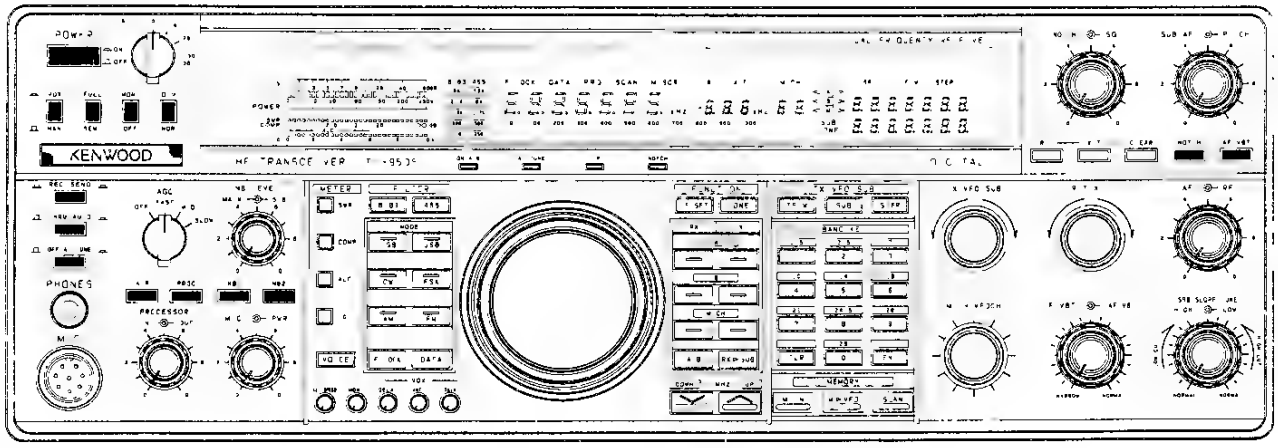
Preparation

Unless otherwise specified, set the controls as follows:

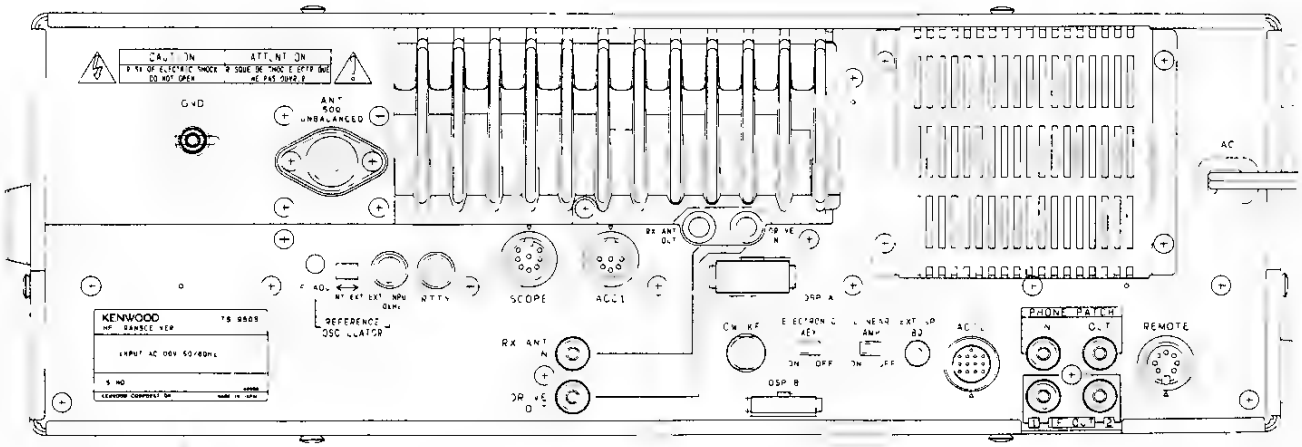
1. Power ON, holding A=B SW, keep ☐ condition from ☐ or ▭ SW's which marked ■.
   (other push SW's are nonlock type or tact SW.)

2 POWER ..... ON
ATT 0
AGC ..... FAST
METER ..... POWER
NB LEVEL 0
PROCESSOR IN 0
PROCESSOR OUT 0
MIC 0
PWR ..... MAX
NOTCH ..... Centered
SQL 0
PITCH ..... Centered
AF 0
RF ..... MAX
IF VBT ..... NORMAL
CW VBT ..... NORMAL
SSB SLOPE TUNE HIGH ..... MAX
SSB SLOPE TUNE LOW ..... MAX

Front panel



Rear panel



ADJUSTMENT

Voltage check

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1 Vo tage	1) POWER SW ON STBY . REC MODE CW	DC V M	AVR (A/6)	TP1	AVR (A/6)	VR1	15 0V	±0 2V

PLL and CAR section adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1 Reference OSC	1) POWER SW ON STBY REC MODE CW	f counter	PLL	TP1	CAR	TC1	20 000 000Hz	±20Hz
2 SCOPE sub marker	1) Connect the SM-230 (±25kHz span) to SCOPE connector on the rear panel. SUB ON RX→SUB ON (MAIN=SUB) MAIN DISP . 10kHz up SUB OFF	DC V M	Rear panel	SCOPE 7 p n	DIG	VR1	0V	±0 01V
3 EXT STD voltage adj.	1) CAR unit S1 EXT Connect the 10kHz/1Vp-p signa. generator to EXT terminal (J1).	DC V M 10kHz signal generator	CAR Rear panel	TP7 EXT INPUT	CAR	TC2	2 5V	±0 2V
TS-950SD	2) CAR unit S2 · SO	f. counter	PLL	TP1			Check	20 000 000MHz ± 20Hz
4 VCO adj. 4-1 VCO5 35 5MHz	1) MAIN DISP . 14.000.0MHz MODE FM STBY REC	DC V.M	CAR	TP1	CAR	L3	4 0V	±0 2V
4-2 VCO6 71 5MHz				TP2		L10	4 0V	±0 2V
4-3 VCO4 69.5MHz				TP3		L17	4 0V	±0 2V
4-4 VCO9 59 5MHz	2) MODE LSB			TP4		L24	5 0V	±0 2V
5 HET adj. 9 285MHz	1) MAIN DISP . 14.000 0MHz MODE . USB STBY REC	Oscilloscope (100MHz)	CAR	TP5	CAR	L14	Level MAX	Ref. 0.4Vp-p
6 CAR adj 10.695MHz	1) MA.N DISP 14 000 0MHz MODE : USB STBY REC	Osc..loscope	CAR	TP6	CAR	L21	Level MAX	Ref 0 4Vp-p
7 40MHz BPF adj	1) MAIN DISP 14 000 0MHz MODE LSB STBY REC	Oscilloscope	PLL	TP6	PLL	L19,20	Leve MAX	Ref 0 8Vp-p
8 VCO adj VCO3 58~56MHz	1) MAIN DISP 14.000 0MHz MODE FM STBY REC	DC V M	PLL	TP2	PLL	L3	5 0V	±0.2V
	2) Turn to main tuning knob MAIN DISP 13 999 9MHz						Check	3 0~4 0V
9 12 85MHz BPF adj	1) MAIN DISP 14 005 0MHz MODE · FM STBY REC	Oscilloscope	PLL	TP3	PLL	L7~9	Leve MAX	Ref 0 3Vp-p
10 34.1MHz BPF adj.	1) MAIN DISP 14 250 0MHz MODE FM STBY REC	Osc lloscope	PLL	TP4	PLL	L10~ L12	Level MAX	Ref 0.4Vp-p
11 VCO adj. VCO2 49 5~ 44.5MHz	1) MAIN DISP 14.000 0MHz MODE · FM STBY REC	DC V M	PLL	TP5	PLL	L15	6 0V	±0 2V
	2) Turn to main tuning knob MAIN DISP 13 999.9MHz						Check	2.0~3 0V

ADJUSTMENT

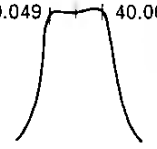
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
12 Local 35 3MHz BPF adj	1) MA N D SP . 14 250 0MHz MODE FM STBY REC	Oscilloscope	PLL	TP7	PLL	L21~ L23	Level MAX	Ref 0 3Vp-p
13 HET 50 750MHz OSC adj	1) MA N D SP 14 250 0MHz MODE FM STBY REC	Oscilloscope	PLL	TP11	PLL	L57	Leve MAX	Ref 0 3Vp-p
		f counter				TC1	50 750MHz	±50Hz
14. VCO adj. VCO8 109-107MHz	1) SUB D.SP 14 000 0MHz MODE : FSK SUB ON STBY REC	DC V M	PLL	TP8	PLL	L31	5 0V	±0 2V
	2) Turn to sub tuning knob SUB D SP 13 999 9MHz						Check	3 0~4 0V
15 25 40MHz BPF adj	1) SUB D SP 14 005 0MHz MODE . FSK STBY REC	Oscilloscope	PLL	TP9	PLL	L35~ L37	Level MAX	Ref 0 3Vp-p Note Adjust clockwise from surface position (core is inserted)
16. 12 54MHz BPF adj	1) SUB DISP 14 005.0MHz MODE FSK STBY REC	Oscilloscope	PLL	TP10	PLL	L41~ L43	Level MAX	Ref 0 4Vp-p
17 38 21MHz BPF adj.	1) SUB DISP . 14.005 0MHz MODE FSK STBY REC	Oscilloscope	PLL	TP12	PLL	L44~ L46	Level MAX	Ref 0 3Vp p
18 VCO adj. 18-1 VCO7-A 40.065~ 47 555MHz	1) MAIN DISP 0.010MHz SUB DISP 0.010MHz MODE FSK STBY · REC	DC V.M	PLL	TP13	PLL (VCO)	TC4	2 8V	±0 2V
	2) SUB DISP 7.500MHz MAIN DISP . 7 490MHz						Check	8 0~11 0V
18-2. VCO7-B 47 555~ 54.555MHz	1) MAIN DISP · 7.500MHz SUB DISP · 7 500MHz			TP14	PLL (VCO)	TC3	2 8V	±0 2V
	2) SUB DISP 14 500MHz MA N D.SP · 14 490MHz						Check	8.0~11 0V
18-3. VCO7-C 54 555~ 61 555MHz	1) MAIN DISP 14 500MHz SUB DISP · 14 490MHz				PLL (VCO)	TC2	2 8V	±0 2V
	2) SUB DISP . 21 500MHz MA N DISP . 21 490MHz						Check	8 0~11 0V
18-4. VCO7-D 61 555~ 70 055MHz	1) MA.N D.SP · 21 500MHz SUB DISP . 21 500MHz				PLL (VCO)	TC1	2 8V	±0 2V
	2) SUB DISP 30 000MHz MA.N D SP 30 000MHz						Check	8 0~11 0V
19. VCO adj VCO0 64 22MHz	1) STBY REC	DC V M	AF	TP2	AF (VCO2)	TC1	5 0V	±0 2V
20 VCO adj. 20-1 VCO1-A 73 06~ 80.55MHz	1) MAIN DISP 0 010MHz MODE FM STBY REC	DC V M	AF	TP1	AF (VCO)	TC1	2 8V	±0 2V
	2) MAIN DISP · 7.490MHz						Check	8 0~11 0V
20-2 VCO1-B 80 55~ 87.55MHz	1) MAIN DISP 7 500MHz				AF (VCO)	TC2	2 8V	±0 2V
	2) MAIN DISP · 14 490MHz						Check	8 0~11 0V
20-3. VCO1-C 87 55~ 94 55MHz	1) MAIN DISP · 14.500MHz				AF (VCO)	TC3	2 8V	±0 2V
	2) MAIN DISP 21 490MHz						Check	8.0~11 0V
20-4. VCO1-D 94.55~ 103.05MHz	1) MAIN DISP · 21.500MHz				AF (VCO)	TC4	2 8V	±0 2V
	2) MAIN DISP 30.000MHz						Check	8 0~11 0V

ADJUSTMENT

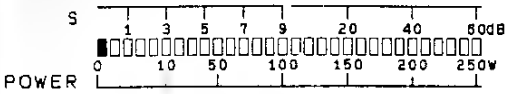
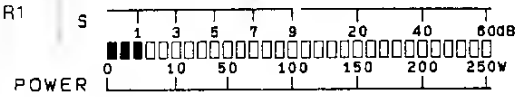
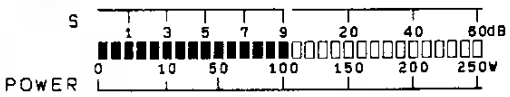
Receiver section adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1 IF VBT	1) MAIN DISP 21.500MHz MODE AM IF VBT MAX	f counter	SIG	CN16-3	SW(B) (J/10)	VR5	355.0kHz	±100Hz
2 Slope tune	1) POWER SW OFF Push the POWER SW ON, holding the 2 and 8 keys down SLOPE TUNE HI, LOW Fully CW position MODE USB	f counter	SIG	CN16-3	SW(B) (K/10)	VR8	353.4kHz	±100Hz
	2) MODE LSB After adjusted. SLOPE TUNE LOW NORMAL					VR7	355.0kHz	±100Hz
3 PITCH	1) POWER SW OFF→ON PITCH : Centered (12 o'clock) MODE CW	f counter	F	CN16-1	SW(B) (K/10)	VR9	10.6935MHz	+20Hz, −0Hz
4-1 MAIN AGC	1) MAIN DISP : 14.000MHz MODE USB RF GAIN MAX	DC V M	SIG	TP1	SUB	VR3	2.8V	±0.01V
4-2 SUB AGC	1) SUB ON IF unit VR2 : MIN After adjusted SUB OFF IF unit VR2 : Centered		IF	TP2	IF	VR3	2.8V	±0.01V
5-1 MAIN MIX BAL	1) MAIN DISP 14.000MHz AF VR MAX After adjusted AF VR : MIN	AF V M	Rear panel	EXT SP	RF	VR2	AF noise level MIN	
5-2 SUB MIX BAL	1) SUB ON SUB DISP 14.000MHz SUB AF VR MAX IF unit VR2 : MAX After adjusted SUB AF VR MIN SUB : OFF					VR1		
6 BPF	1) BAND 2.5~4.5MHz MAIN DISP : 3.500MHz AIP : OFF AGC OFF	Spectrum analyzer Tracking generator	RF	TP3	RF	L19~L21		2.5 4.5MHz 
	2) BAND 6.5~7.5MHz MAIN DISP 7.000MHz					L25~L27		6.5 7.5MHz 
	3) BAND 9.5~11.0MHz MAIN DISP 10.000MHz					L31~L33		9.5 11.0MHz 
	4) BAND 13.5~15.0MHz MAIN DISP 14.000MHz					L37~L39		13.5 15.0MHz 
	5) BAND : 20.5~22.0MHz MAIN DISP : 21.000MHz					L46~L48		20.5 22.0MHz 

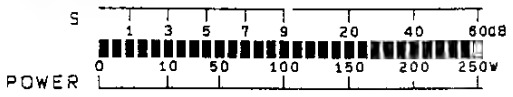
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
6. BPF	6) BAND 23.0~30.5MHz MAIN DISP 28.000MHz	Spectrum analyzer Tracking generator	RF	TP3	RF	L52~L54		23.0 30.5MHz 
7-1. MAIN MCF 73.050MHz	1) MAIN DISP 14.175MHz Tracking generator output −30dBm Center frequency 73.050MHz	Spectrum analyzer Spectrum analyzer	IF	TP3 CN6	IF	L9~11	Crest value MAX Ripple MIN Adjust as shown at right	73.050 73.043 73.057MHz 
7-2 SUB MCF 40.055MHz	1) Center frequency 40.055MHz	Spectrum analyzer Tracking generator	IF RF	TP1 TP4	IF RF	L1 L77~L80		40.055 40.049 40.061MHz 
8-1. MAIN RX IF AMP	1) MAIN DISP 14.175MHz MODE USB AGC : OFF AIP OFF SUB AF VR : MIN AF VR : 0.63V/8Ω SSG f 14.176MHz SSG output 5~0.5μV (−93~−113dBm) Note Use the minimum input as possible.	SSG DM SP Oscilloscope AF V M	Rear panel	ANT EXT SP	RF IF SIG	L87 L12~L17 L20,30 L2,4 L5,7	Repeat for MAX AF output reading	
	2) Set the indicator of FILTER 8.83 select switch to disappear position. After adjusted Set the FILTER select switch 2.7kHz position.				IF	L28,29	MAX for AF output	
8-2. SUB RX IF AMP	1) SUB ON SUB DISP 14.175MHz MODE USB AF VR : MIN SUB AF VR 0.63V/8Ω AF unit VR1 12 o'clock IF unit VR2 : 12 o clock SSG f 14.176MHz SSG output 5~0.5μV (−93~−113dBm) Note : Use the minimum input as possible After adjusted SUB : OFF				RF IF	L77 L1~8	Repeat for MAX AF output reading	
9 IF OUT1	1) SSG output : 50mV (−33dBm) AGC OFF	SSG Oscilloscope	Rear panel	ANT IF OUT1	IF	L18,19	MAX for 8.83MHz signal output.	

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
10. NOTCH	1) MAIN DISP 14.175MHz MODE CW NOTCH VR 12 o'clock PITCH VR 12 o'clock SUB AF VR MIN SSG f 14.176MHz SSG output 0.5μV (–113dBm)	SSG DM SP Oscilloscope AF V M f counter	Rear panel	ANT EXT SP	Front panel	AF VR Main encoder	Adjust for 1500Hz/ 0.63V/8Ω AF output.	
	2) NOTCH SW ON SSG output 50μV (–73dBm) After adjusted NOTCH SW OFF				S.G	L6 VR2	Repeat for MIN AF output reading	
					Front panel	NOTCH VR	Check	Null point must occur between 11 00 ~ 13 00 Then AF output s ess than 0.63V/8Ω
11-1 MAIN S-meter and RX GAIN	1) MAIN DISP 14.175MHz MODE USB AGC OFF RF GAIN VR MAX ATT OFF SSG RF OFF	SSG 8Ω dummy SP Oscilloscope AF V M f counter	Rear panel	ANT EXT SP	S.G	VR4	Set the S meter to 1 dot just before 2 dots lights) 	
	2) AGC FAST SSG f 14.176MHz SSG output 0.9μV (–108dBm)					VR1	Set the S meter to 3 dots just before 4 dots lights)	
	3) SSG output 1.26μV (–105dBm)					VR4		
	4) SSG output 1μV (–107dBm)					VR1		
	5) SSG output : 12.6μV (–25dBm)					VR5	S9+60dB (Full scale)	
	6) SSG output 2μV (–81dBm)						Check 	Within S9 +4, –8dBμ
	7) SSG output : 1μV (–107dBm)						Check	S1 (3 dots) lights, ±3dBμ
	8) Repeat item 1) to 7).							
	9) SSG output : 3.55μV (–36dBm)						Check SSG level of S9+60dB reading.	3.55μV (–36dBm)
11-2. SUB RX GAIN	1) SUB ON SUB DISP 14.175MHz MODE USB SSG f 14.176MHz SSG output . 1μV (–107dBm) After adjusted SUB OFF	DC V M	F	TP2	IF	VR2	2.75V Adjust for slowly	±0.03V
12. FM GAIN	1) MAIN DISP 28.200MHz MODE FM SIG unit VR10 12 o'clock SSG f 28.200MHz SSG MOD 1kHz SSG DEV 3kHz SSG output 50μV (–73dBm)	SSG 8Ω dummy Oscilloscope SP AF V M	Rear panel	ANT EXT SP	S.G	L28	MAX for AF output.	
					Front panel	AF VR	Set to 0.63V/8Ω by AF GAIN volume.	
	2) SSG MOD 1kHz SSG DEV 5kHz SSG output : 50μV (–73dBm)				SIG	VR10	Adjust to 0.63V/8Ω AF output	
	3) SSG DEV 3kHz						Check AF output	0.45V/8Ω or more.

ADJUSTMENT

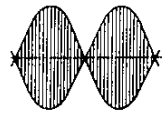
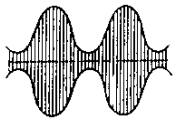
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
13. FM S-meter	1) SSG f 28 200MHz SSG MOD 1kHz SSG DEV 3kHz SSG output 11 2μV (86dBm)	SSG 8Ω dummy Osc oscope AF V M	Rear panel	ANT EXT SP	S G	VR11	ust before 60 dots ghts 	
	2) SSG output 0 5μV (–113dBm)						Check SSG evle of S1 reading	–5~5dBμ
14-1 MAIN NB	1) MA N DISP 21 200MHz MODE USB SUB AF VR MIN SUB NB VR . M.N NB1 SW ON MAIN NB VR 12 o clock	No.se generator SP	Rear panel	ANT EXT SP			Adjust the no se generator output to S-meter 1 to 3 dots ghts Ad ust the MAIN NB LEVEL to just before NB operates has insuff cient effect	
					AF	L13,14	M N noise evel	
	2) MAIN NB → SUB check MAIN AF VR MIN SUB NB VR · M.N MAIN NB VR . 12 o clock NB1 SW · ON NB2 SW . ON						Adjust the raise noise generator level to S1 and S9 then check	Noise disappears
14-2 SUB NB	1) SUB ON SUB DISP 21 200MHz MODE USB MAIN AF VR M N MAIN NB VR MIN NB1 SW ON SUB NB VR . 12 o'clock						Adjust the no se generator output to S-meter 1 to 3 dots ights Adjust the SUB NB LEVEL to just before NB operates has nsufficient effect	
					F	L21,22	MIN noise level	
	2) SUB NB → MAIN check SUB AF VR MIN MAIN NB VR MIN SUB NB VR · 12 o'clock NB1 SW ON NB2 SW . ON After adjusted SUB . OFF NB1, NB2 SW : OFF						Adjust the raise noise generator leve. to S1 and S9 then check	No.se disappears
15. Beep tone	1) AF VR · MIN CW key · 1 push	DM SP Oscilloscope	Rear panel	EXT SP (A/3)	CONT	VR1	0 3Vp-p	0 2~0 4Vp-p

ADJUSTMENT

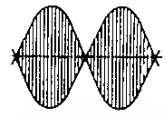
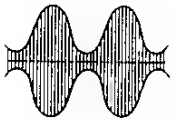
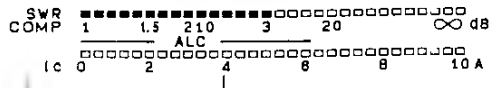
Transmitter section adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. ALC voltage	1) MAIN DISP 14.200MHz MODE USB PWR VR MAX STBY SEND	Digital voltmeter	IF	CN3-1	CONT (A/3)	VR5	2.7V	±0.05V
2. CAR MIX & AMP	1) MODE AM MIC VR MIN STBY SEND	Oscilloscope	SIG	Center pin of the VR9	SIG	L10~L12	Repeat for MAX	3Vp-p or more
3. TX IF AMP	1) MAIN DISP 7.050MHz SW unit (A) VR11 (CAR VR) MAX Disconnect the CN4 on the IF unit and connect the spectrum analyzer STBY SEND	Spectrum analyzer	IF	CN4	SIG IF	L16,18 L23~L27 L31	MAX for 73MHz signal output	Approx. 0dBm or more
4. 64.2MHz spurious	1) MAIN DISP 7.050MHz SW unit (A) VR11 (CAR VR) MAX Disconnect the CN4 on the IF unit and connect the spectrum analyzer. STBY · SEND After adjusted Connect the CN4	Spectrum analyzer	IF	CN4	IF	VR4	MIN spurious level	
5. 8.83 MCF	1) MAIN DISP 7.050MHz SW unit (A) VR11 (CAR VR) MAX MODE · AM STBY : SEND	Tracking generator Spectrum analyzer (strobe)	IF Filter (C/3)	CN17-1 CN12-2	IF (Filter (C/3))	L12,13		8.83MHz ±2.5kHz
6. TX IFT	1) MODE . AM RF unit VR4~6 Centered STBY SEND	Spectrum analyzer	Rear panel	DRV OUT	RF	L93~L95	Repeat for MAX	
7. MIX BIAS	1) MAIN DISP . 7.050MHz MODE AM STBY SEND	Spectrum analyzer	Rear panel	DRV OUT	RF	VR4	MAX	
	2) MAIN DISP · 14.050MHz					VR5	MAX	
	3) MAIN DISP 29.000MHz					VR6	MAX	
8. MIX BAL	1) MAIN DISP : 21.000MHz MODE · AM STBY SEND	Spectrum analyzer	Rear panel	DRV OUT	RF	VR3	MIN 31MHz spurious level	
9-1. FINAL Vcc	1) MAIN DISP 21.000MHz MODE CW Final unit VR1, 2 · MIN STBY . SEND	DC V.M	Final	Fuse	Final	VR3	48.0V	±0.5V
9-2. Drive bias	1) MODE USB STBY SEND	Ammeter		TP1		VR1	170mV	165~175mV
9-3. Final bias				TP2		VR2	25mV	24.5~25.5mV
10. NULL	1) MAIN DISP 14.200MHz MODE AM Control unit VR6 Centered VR7 . MAX VR12 · MAX SW unit (A) VR11 (CAR VR) MIN STBY SEND	Power meter DC V.M	Rear panel Filter	ANT CN6-1	SW(A) (L/10) Filter	VR11 TC1	Approx. 10W MIN DC V.M level	0V

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
11 IC meter	1) METER IC ON SW unit (A) VR11 (CAR VR) MIN STBY SEND	DC V.M	Final	TP2	SW(A) (J/10)	VR11	0.4V	
					CONT (A/3)	VR4	IC meter 4 dots lights	Check, IC meter 4 dots will disappeare when adjust the CAR VR to 0.38V or more
12 IC protection	1) SW unit (A) VR11 (CAR VR) MIN Control unit VR12 MAX VR6 : MIN VR7 MAX Adjust while slowly raising CAR VR, then 200W Note . Please adjust VR6 and VR12 immediately, because power output will appear over 200W	Power meter	Rear pane	ANT	CONT (B/3)	VR12	190W	
					CONT (A/3)	VR6	185W	
13. ALC	1) MAIN DISP 14.200MHz MODE : CW FULL : ON SW unit (A) VR11 (CAR VR) MIN Control unit VR12 MIN STBY SEND	Power meter	Rear panel	ANT	SW(A) (J/10)	VR11	Slowly increase to MAX	
					CONT (B/3)	VR12	110W	100~120W
14 ALC frequency response	1) MAIN DISP 24.900MHz STBY SEND	Power meter	Rear panel	ANT	Filter	VR1	110W	100~120W
	2) MAIN DISP 14.200MHz STBY SEND						Check if less than 100W, readjust item 13.	100~120W
15 Power meter	1) MAIN DISP . 14.200MHz MODE CW STBY . SEND	Power meter	Front pane	Power meter	Front panel	PWR VR	100W	
					CONT (B/3)	VR11	Set the PWR meter of display to "100W" segments	"100W" segment will disappear when adjust the CAR VR to less than 97W
16. Carrier suppression	1) MAIN DISP . 14.200MHz MIC VR MIN SW unit (A) VR11 (CAR VR) : MAX MODE USB/LSB PWR VR : MAX STBY : SEND Spectrum analyzer conditions SPAN . 10kHz RBW 300Hz VIDEO FIL. : 300Hz TIME 500ms	Power meter Directional coupler Spectrum analyzer	Rear panel	ANT	SIG	TC1 VR9	MIN (adjust alternately) Adjust for no difference between USB and LSB	45dB or less
17-1 MAIN SSB mode frequency response	1) POWER SW OFF Push the POWER SW ON holding the 1 and 7 keys down PROC : OFF MODE USB/LSB MIC terminal : 2-tone AG1 : 900Hz/5mV AG2 3.5kHz/5mV MIC VR : Set to starting point of ALC meter STBY SEND Set the FILTER select 8.83 to 6kHz when transmit.	Power meter Directional coupler Oscilloscope AG AF V.M	Rear panel Front panel	ANT MIC	DIG	VR4 (USB) VR3 (LSB)	Adjust as shown at right	OK  NG 

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
17-1 MAIN SSB mode frequency response	* Receive sound Push the POWER SW ON holding the 3 and 9 keys down	Power meter Directional coupler Oscilloscope AG AF V M	Rear panel Front panel	ANT MIC	D G	VR4 (USB) VR3 (LSB)	Adjust for requirement sound with monitor receiver	
17-2 SSB mode frequency response	1) MAIN DISP 14.200MHz MODE USB/LSB MIC terminal 2-tone AG1 1kHz/5mV AG2 3.4kHz/5mV MIC VR Set to starting point of ALC meter STBY SEND Set the FILTER select 8.83 to 2.7kHz when transmit					VR2	Adjust as shown at right	OK  NG 
17-3 SUB SSB mode frequency response	1) MAIN DISP 14.220MHz POWER SW OFF Push the POWER SW ON holding the 3 and 9 keys down SUB ON AF VR MIN SUB AF VR MAX MODE USB/LSB STBY SEND			SP		VR5	Adjust for same noise frequency response	
18 PROC AMP	1) MAIN DISP 14.200MHz MODE . USB PROC SW · ON METER COMP ON PROC OUT VR · MAX MIC terminal : 2-tone AG1 : 1kHz/5mV AG2 3.4kHz/5mV STBY SEND After adjusted POWER SW OFF → ON PROC SW OFF	Power meter Directional coupler Oscilloscope AG AF V M	Rear panel Front panel	ANT MIC	SIG	L24,25	Adjust the PROC IN VR to no indication of COMP and ALC meter MAX oscilloscope wave reading.	
19 Carrier suppression check	1) MODE USB/LSB MIC VR M.N SW unit (A) VR11 (CAR VR) MAX PWR VR MAX STBY SEND	Power meter Directional coupler Spectrum analyzer Osc. oscope	Rear panel	ANT			Check	45dB or less
20 SWR protection	1) MAIN DISP · 14.200MHz MODE AM Control unit VR7 MIN ANT Connect the through line power meter and 150Ω dummy load STBY SEND	Through line power meter 150Ω dummy	Rear panel Front panel	ANT Power meter	CONT (A/3)	VR7	10W Note Please adjust quickly	±1W
21. SWR meter	1) MAIN DISP 1.800MHz METER SWR · Push ANT : Connect the 150Ω dummy oad. STBY SEND	150Ω dummy	Rear panel Front panel	ANT SWR meter	CONT (A/3)	VR8	SWR 3	
22. MIN power setting	1) MAIN DISP · 14.200MHz PWR VR MIN STBY · SEND After adjusted PWR VR . MAX	Power meter	Rear panel	ANT	CONT (B/3)	VR10	12W	10~14W

ADJUSTMENT

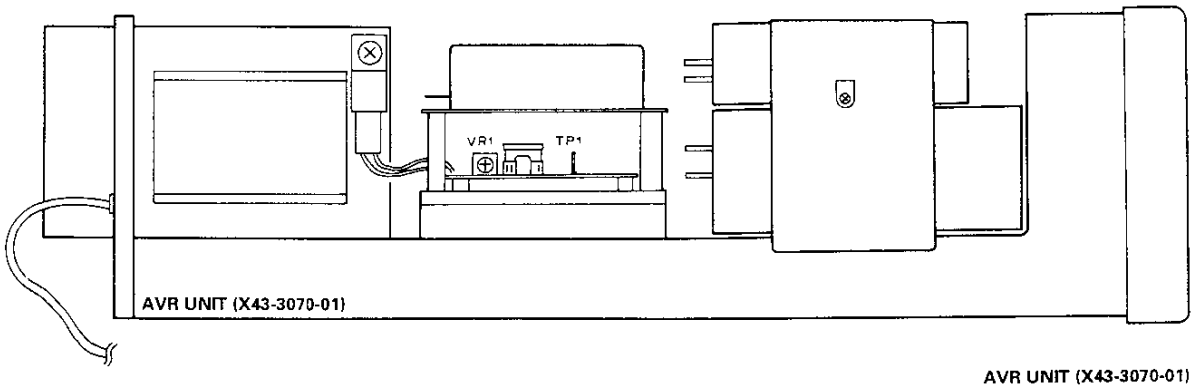
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
23-1 A_C meter ZERO	1) MAIN DISP 14 200MHz MODE USB Control unit (A/3) VR3 Centered STBY SEND	DC V M	CONT (A/3)	VR3	CONT (A/3)	VR2	0 01V	÷0 001V
23-2 ALC meter FULL	1) M C terminal AG (1kHz/5mV) METER A_C Push STBY . SEND	Power meter	Rear panel	ANT	Front panel	MIC GA N	Set the MIC GAIN VR to 1 dot of ALC meter (just before 1 dot ghts)	
	2) M C terminal AG (1kHz/10mV) STBY SEND	AG AF V M	Front panel	M C ALC meter	CONT (A/3)	VR3	Adjust for MAX A_C zone reading	
24 PROC meter	1) MODE USB METER COMP Push PROC SW ON M C terminal . AG (1kHz/1mV) STBY SEND	Power meter	Rear panel	ANT	Front panel	PROC IN VR	Set the PROC IN VR to 1 dot of COMP meter just before 1 dot ghts)	
	2) MIC terminal AG (1kHz/10mV) STBY SEND After adjusted PROC SW OFF	AG AF V M	Front panel	M C COMP meter	CONT (A/3)	VR9	Adjust for 20dB COMP meter	
25-1 FM MIC DEV	1) MAIN DISP 29 050MHz MODE FM FILTER 455 12kHz MIC terminal AG (1kHz/30mV) STBY SEND	Power meter Directional coupler Linear detector Oscilloscope	Rear panel	ANT	AF	VR5	DEV ±4 6kHz	
25-2. MIC GAIN	1) MIC terminal AG (1kHz/3mV) **W,W2,X** AG (1kHz/5mV) **K,M,P** STBY · SEND	AG AF V M	Front panel	MIC		VR6	DEV ±3 0kHz	±0 1kHz
25-3 MIC GAIN (FM narrow)	1) FILTER 455 6kHz MIC terminal AG (1kHz/30mV) STBY · SEND					VR4	DEV ±2 3kHz	±0 1kHz
	2) MIC terminal · AG (1kHz/3mV) **W,W2,X** AG (1kHz/5mV) **K,M,P** STBY : SEND						Check	DEV ±1 4–1 6kHz
26 SUB TONE	1) MAIN DISP 29 700MHz MODE FM FUNCTION TX VFO B A=B key 1 push TONE · ON MIC terminal . Open STBY SEND After adjusted TONE OFF TX VFO · A	Power meter Directional coupler Linear detector Oscilloscope AF V M	Rear panel	ANT			Check that SUB TONE indication w appeare to 88 5c	Please press the TONE key if disappeared
					AF	VR3	DEV ±600Hz	±50Hz
27. FM carrier	1) MAIN DISP 29 700MHz MODE FM METER ALC ON M C terminal Open STBY · SEND	Power meter Directional coupler	Rear panel	ANT	SIG	VR6	Adjust for MAX ALC zone reading	
28-1. DSP TS-950SD	1) DSP unit S1 . 1 S2 1 S3-1 OFF S3-2 · OFF S3-3 OFF S3-4 . ON TP5 Short (ON)	Power meter	Rear panel	ANT	F	VR5	Set to mechanical centered point	

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
28-2. GAIN 1	2) MAIN DISP 14 200MHz MODE AM METER ALC ON STBY SEND	Power meter	Rear panel	ANT	SIG	L22	Power MAX	Set the SW unit (A) VR11 (CAR VR) to 10W Also discrease the CAR VR to no ALC reading when adjust item 28-2
28-3 GAIN 2	3) MODE USB STBY SEND					VR8	Adjust for full scale of ALC meter	
28-4 FM GAIN	4) MAIN DISP 29 700MHz MODE FM METER ALC ON STBY . SEND					VR7	Adjust for MAX ALC zone reading	
29 DSP MIC GAIN TS-950SD	1) MIC terminal · AG (1kHz/5mV) STBY : SEND	Power meter	Rear panel	ANT	Front panel	MIC GAIN VR	Set the MIC GAIN VR to 1 dot of ALC meter (Just before 1 dot lights).	
	2) MIC terminal AG (1kHz/10mV) STBY SEND				DSP	VR1	Adjust for MAX ALC zone reading.	
30 DSP unit VCO TS-950SD	1) Connect the two DSP connector to the rear panel MAIN DISP Any frequency STBY SEND	DC V M	DSP	TP6	DSP	L12	4V	±0.2V
31 Monitor level	1) MAIN DISP 21 050MHz MODE USB MONI SW · ON MONI VR · 12 o'clock ALC SW . ON MIC terminal AG (1kHz/10mV) STBY SEND MIC VR ALC zone MAX	Power meter DM. SP Oscilloscope AF V.M	Rear panel	ANT EXT SP	IF	VR1	Set to mechanical centered point.	
							Check	0.3~1.0V/8Ω
32 CW sidetone	1) MAIN DISP · 21 050MHz MODE CW MONI SW . OFF PITCH VR 12 o'clock VOX SW · ON FUNCTION TX A FUNCTION RX A Rear panel ELECTRONIC KEY OFF LINEAR AMP ON	Power meter f counter AF V.M	Rear panel	ANT EXT SP	AF	VR2	Adjust to 0.2V/8Ω with key down	±0.02V
33 Auto antenna tuner	1) MAIN DISP · 1 900MHz MODE CW AUTO/THRU AUTO AT TUNE · ON	Oscilloscope 50Ω dummy SWR meter (Front panel)	Rear panel	ANT	AT (A/2)	VR1	Adjust VR1 to fully CCW position Adjust VR1 slowly increase, 2 dots of SWR meter just goes off	
						VR2 TC1	Set to mechanical centered point	Do not hang-up when tuning in 28MHz bands.
		150Ω dummy					Check	Motor stop until all band.

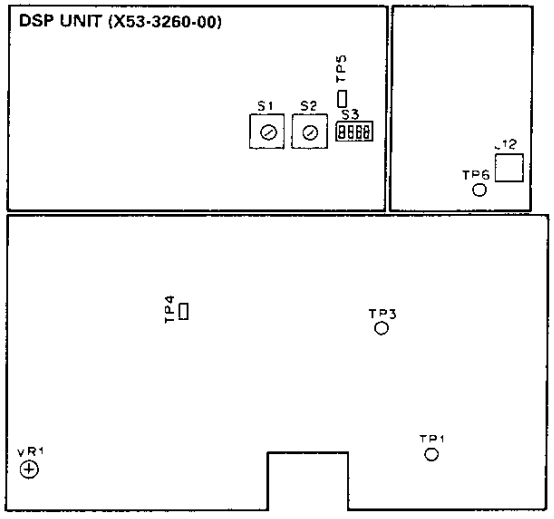
ADJUSTMENT

Adjustment points (AVR unit)



AVR UNIT (X43-3070-01)
VR1 . 15V adj

Adjustment points (DSP unit)



DSP UNIT (X53-3260-00) : TS-950SD
⌐12 VCO
VR1 MIC GAIN

CAR UNIT (X50-3110-XX)
L3 . VCO5 (35 5MHz)
L10 VCO6 (71 5MHz)
L14 HET (9 285MHz)
L17 VCO4 (69 5MHz)
L21 CAR (10 695MHz)
⌐24 VCO9 (59 5MHz)
TC1 Ref OSC (20MHz)
TC2 EXT STD voltage

PLL UNIT (X50-3100-00)
L3 VCO3 (58~56MHz)
L7~9 12.85MHz BPF
L10~12 34 1MHz BPF
⌐15 VCO2 (49 5~44 5MHz)
⌐19,20 40MHz BPF
L21~23 LOCAL (35.3MHz) BPF
L31 VCO8 (109~107MHz)
L35~37 25.40MHz BPF
L41~43 12.54MHz BPF
L44~46 38 21MHz BPF
⌐57 . HET (50 75MHz) OSC
TC1 HET (50.75MHz) OSC

VCO (X58-3630-01)
TC1 VCO7-D (61 555~70.055MHz)
TC2 VCO7-C (54 555~61 555MHz)
TC3 VCO7-B (47 555~54 555MHz)
TC4 VCO7-A (40.065~47 555MHz)

RF UNIT (X44-3100-00)
L19~21 2 5~4 5MHz BPF
L25~27 6 5~7 5MHz BPF
L31~33 9 5~11 0MHz BPF
L37~39 . 13 5~15 0MHz BPF
L46~48 20 5~22 0MHz BPF
L52~54 · 23~30 5MHz BPF
L77~80 SUB MCF (40 055MHz)
L87 MAIN RX IF AMP
⌐93~95 · TX FT
TC1 73 05MHz trap
VR1 RX SUB MIX balance
VR2 · RX MAIN MIX balance
VR3 TX MIX balance
VR4 TX MIX bias (7MHz)
VR5 · TX MIX bias (14MHz)
VR6 . TX MIX bias (29MHz)

AF UNIT (X49-3020-00)
L13,14 MAIN NB GAIN
VR1 VBT (Centered)
VR2 · CW sidetone
VR3 · SUB TONE DEV
VR4 Narrow FM MIC GAIN
VR5 FM M C DEV
VR6 MIC GAIN

VCO2 (X58-3390-03)
TC1 . VCO0 (64 22MHz)

VCO (X58-3630-00)
TC1 VCO1-A (73 06~80.55MHz)
TC2 . VCO1-B (80 55~87 55MHz)
TC3 · VCO1-C (87 55~94.55MHz)
TC4 · VCO1-D (94.55~103 05MHz)

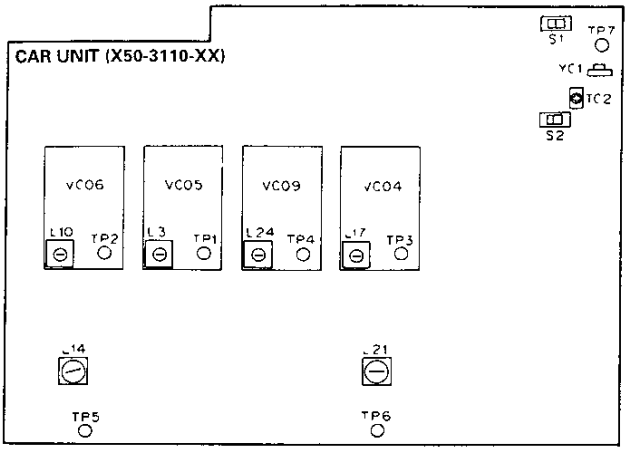
IF UNIT (X48-3060-00)
⌐1~8 RX SUB IF AMP
L9~11 RX MAIN MCF
⌐12~17 · RX MAIN IF AMP
⌐18,19 IF OUT1
⌐20 RX MAIN IF AMP
⌐21,22 SUB NB GAIN
L23~27 · TX IF AMP
L28~30 : RX MAIN IF AMP
L31 TX IF AMP
VR1 MONI level
VR2 SUB RX GAIN
VR3 SUB AGC
VR4 64 2MHz TX spurious
VR5 · DSP (TS-950SD)

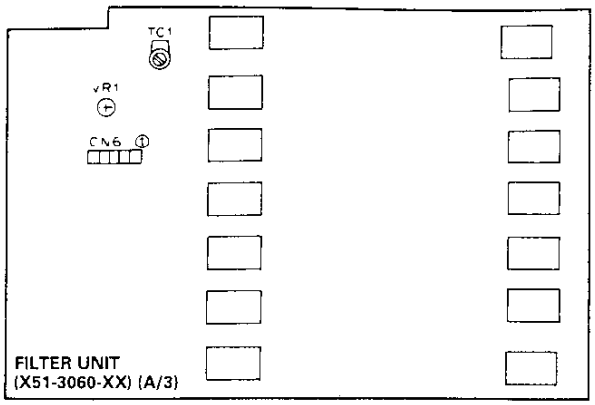
FILTER UNIT (X51-3060-XX) (C/3)
L12,13 8 83MHz MCF

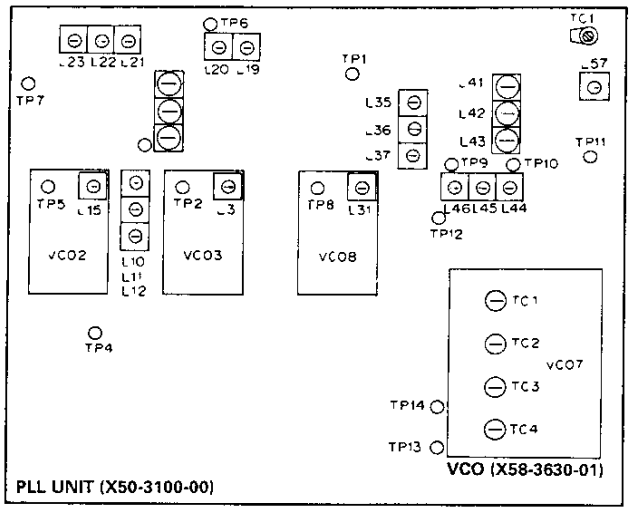
SIGNAL UNIT (X57-3380-00)
L2,4,5,7 RX MAIN IF AMP
L6 NOTCH
L10~12 . TX CAR MIX & AMP
L16,18 · TX F AMP
L22 DSP GAIN (AM)
⌐24,25 PROC AMP
⌐28 . RX FM GAIN
TC1 . CAR suppression
VR1 . MAIN SSB S-1
VR2 NOTCH
VR3 MAIN AGC
VR4 MAIN RX GAIN
VR5 MAIN SSB S-9
VR6 TX FM CAR level
VR7 DSP GAIN (FM)
VR8 DSP GAIN (SSB)
VR9 CAR suppression
VR10 RX FM GAIN
VR11 . RX FM S-meter

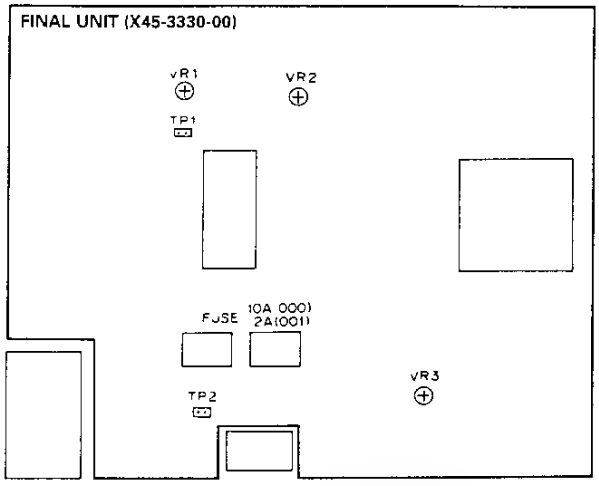
ADJUSTMENT

Adjustment points (Upper side)









FILTER UNIT (X51-3060-XX) (A/3)
VR1 ALC frequency response
TC1 NULL

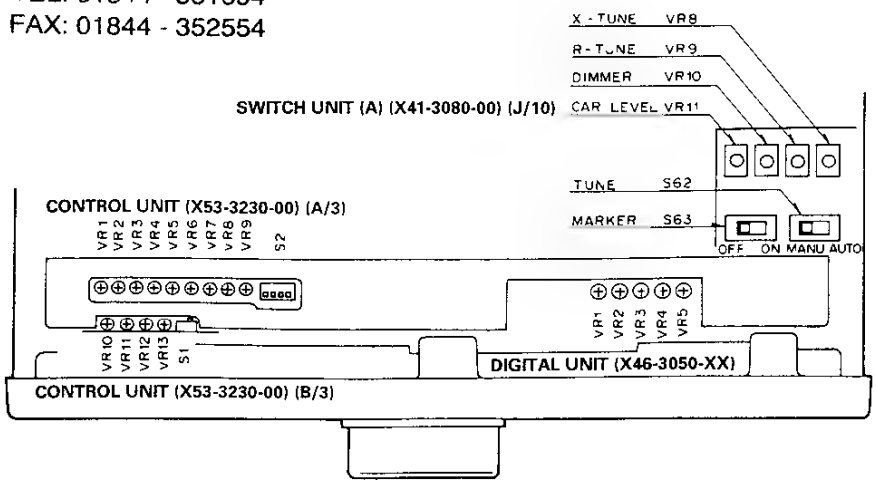
FINAL UNIT (X45-3330-00)
VR1 Drive bias
VR2 Final bias
VR3 Final Vcc

CONTROL UNIT (X53-3230-00) (A/3)
VR1 Beep tone
VR2 ALC meter-ø
VR3 ALC meter full
VR4 IC meter
VR5 ALC voltage
VR6 IC protect on
VR7 SWR protection
VR8 SWR meter
VR9 PROC meter

CONTROL UNIT (X53-3230-00) (B/3)
VR10 TX MIN power setting
VR11 · Power meter
VR12 RF power
VR13 Not used

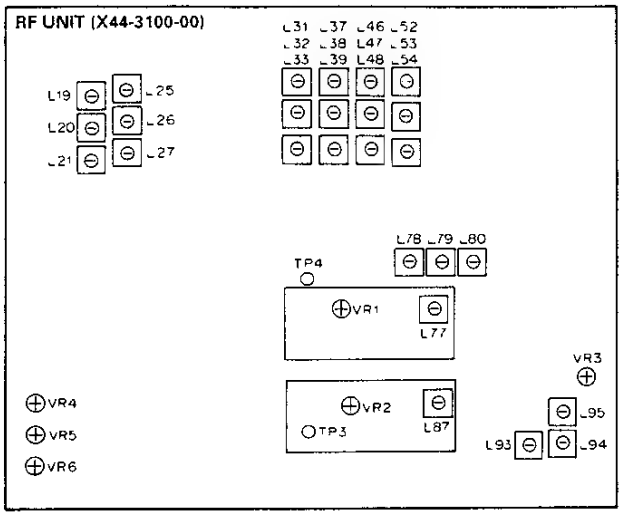
SWITCH UNIT (A) (X41-3080-00) (J/10)
VR8 . MANUAL TONE VR (Centered)
VR9 MANUAL TONE VR (Centered)
VR10 DIMMER (Centered)
VR11 CAR level

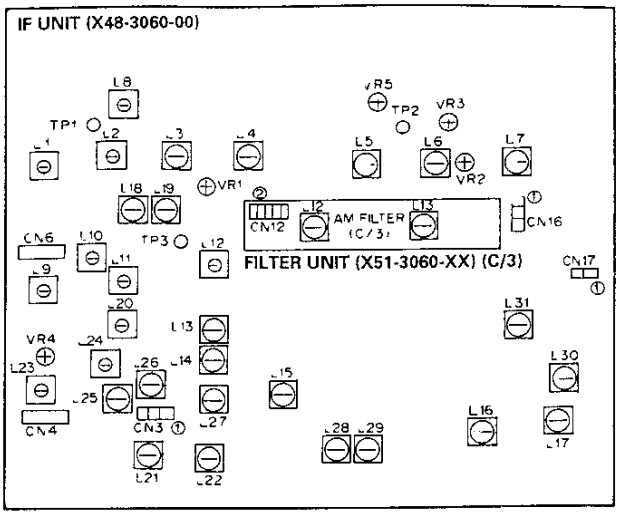
DIGITAL UNIT (X46-3050-XX)
VR1 SCOPE SUB MARKER
VR2 CAR point (LSB/USB)
VR3 CAR point (LSB)
VR4 . CAR po nt (USB)
VR5 CAR point

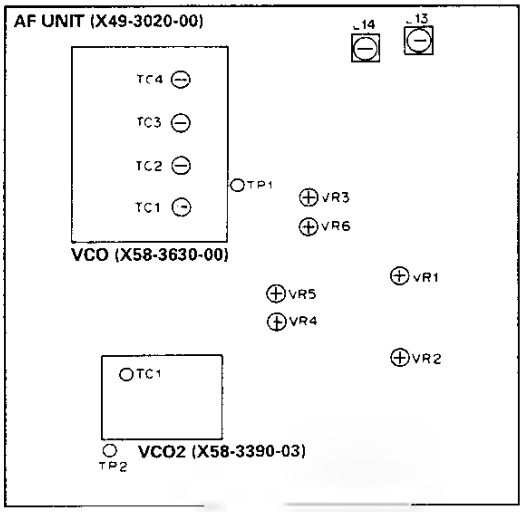


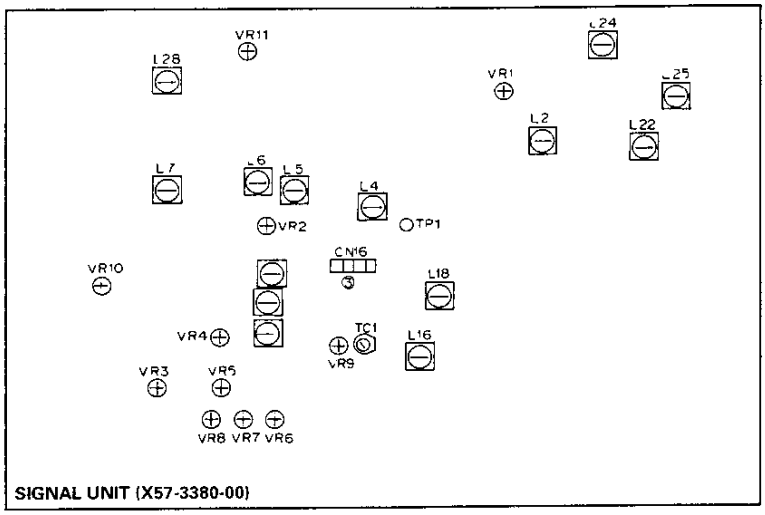
ADJUSTMENT

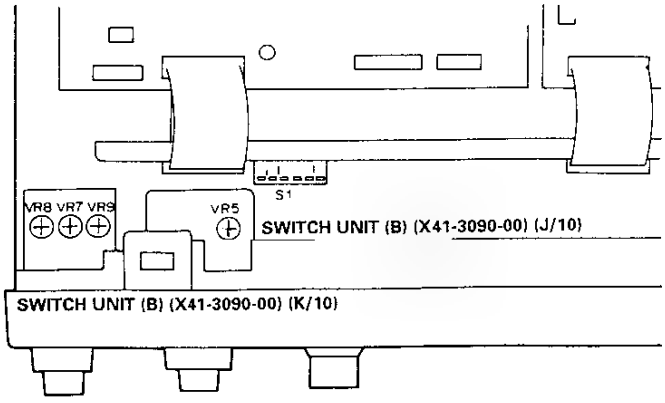
Adjustment points (Lower side)











SWITCH UNIT (B) (X41-3090-00) (K/10)
VR7 Slope tune LSB
VR8 Slope tune USB
VR9 PITCH CW

SWITCH UNIT (B) (X41-3090-00) (J/10)
VR5 IF VBT (355 0kHz)

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
SWITCH UNIT (A) (X41-3080-00)			
CN1 (A/10)	1	LTXB	Transmitter LED signal. Active 'H'
	2	LMTA	AT-TUNE LED signal Active 'H'
	3	LNOT	NOTCH LED signal Active "H
	4	HIPC	AIP LED signal. Active 'L'
CN2 (A/10)	1	GND	GND
	2	MD	MIC down signal
	3	MU	MIC up signal
	4	K0	Key output 0 SW ON "L"
	5	K1	Key output 1. SW ON 'L'
	6	K2	Key output 2 SW ON . L
	7	K3	Key output 3 SW ON L
	8	K4	Key output 4. SW ON L
	9	K5	Key output 5 SW ON "L"
	10	K6	Key output 6 SW ON "L"
	11	K7	Key output 7 SW ON L
	12	S0	Key matrix select signal 0 'L' Select
	13	S1	Key matrix select signal 1 'L' . Select
	14	S2	Key matrix select signal 2 "L" Select
	15	S3	Key matrix select signal 3 'L' . Select
	16	S4	Key matrix select signal 4 'L' Select
	17	S5	Key matrix select signal 5 "L" Select
	18	S6	Key matrix select signal 6 'L' Select
	19	NC	Not used.
	20	GND	GND
CN3 (A/10)	1	MD	MIC down signal
	2	MU	MIC up signal.
	3	NC	Not used
CN4 (A/10)	1	S6	Key matrix select signal 6.
	2	K7	Key output 7.
	3	K6	Key output 6.
	4	K5	Key output 5
	5	NC	Not used
CN5 (A/10)	1	K0	Key output 0.
	2	S5	Key matrix select signal 5.
CN6 (A/10)	1	GND	GND
	2	LRB	Function RX-B LED signal input. Active 'H"
	3	LTB	Function TX-B LED signal input Active "H"
	4	LTM	Function TX-M LED signal input. Active 'H'
	5	LRA	Function RX-A LED signal input Active 'H'
	6	LRM	Function RX-M LED signal input Active 'H'
	7	LK1	Key top LED signal input. Active "H"
	8	LTA	Function TX-A LED signal input. Active "H"
	9	LFSK	FSK LED signal input. Active 'H"
	10	LLSB	LSB LED signal input Active 'H"
	11	LUSB	USB LED signal input. Active "H
	12	LCW	CW LED signal input Active "H'
	13	LAM	AM LED signal input Active 'H'
	14	NC	Not used
	15	NC	Not used.
	16	LFM	FM LED signal input Active H"
	17	TR	TX/RX identity signal output
	18	5DIG	+5V
CN7 (B/10)	1	+15	+15V
	2	VOX	VOX signal
	3	FULL	Full break-in signal
CN8 (B/10)	1	MONI	Monitor ON 'H"
CN9 (B/10)	1	DIM2	Dimmer signal input.
	2	DIM1	Dimmer signal output

Connector No.	Terminal No.	Terminal Name	Terminal function
CN10 (C/10)	1	SS	Standby signal "L" TX
	2	ATA	AT AUTO switch 'L' AUTO
	3	ATS	AT start switch Active 'H'
	4	GND	GND
CN11 (C/10)	1	ATS	AT switch. Active 'H"
	2	+15	+15V input
	3	MONI	Monitor ON/OFF controlled output ON 'H'
CN12 (H/10)	1	AN	Audio signal (TX Mic amplifier output)
	2	GND	GND
CN13 (H/10)	1	PCV	Gain variable voltage for power contro
CN14 (H/10)	1	PKSS	Packet stand-by input. Active 'L'
	2	GND	GND
	3	PRCVR2	Processor IN signal output
	4	GND	GND
	5	MCVR2	Mic volume output signal output
	6	MICAO	Mic amplifier output signal output
	7	GND	GND
	8	GND	GND
	9	PRL2	Processor OUT controlled voltage output
CN15 (H/10)	1	8M	Microphone terminal +8V
	2	GND	GND
	3	SS	Standby signal. L : TX
	4	MG	MIC GND
	5	MIC	MIC signal.
CN16 (H/10)	1	DATC	DATA mode signal input. 'L' DATA mode
	2	POV3	Power volume GND
	3	POV2	Power volume output.
	4	POV1	Power volume input.
	5	SS	Standby signal 'L TX
	6	GND	GND
	7	+8	+8V.
CN17 (E/10)	1	CWD	CW delay controlled voltage output
	2	+15	+15V
	3	KSP2	Electric keyer speed controlled voltage input
	4	KSP1	Electric keyer speed controlled voltage output
CN18 (E/10)	1	GND	GND
	2	VOXVR2	VOX gain controlled voltage output
	3	GND	GND
	4	AVR2	ANTI VOX controlled voltage output
	5	VOXDL	VOX delay controlled voltage output
	6	GND	GND
	7	MONVR2	Monitor signal output.
CN19 (E/10)	1	GND	GND
	2	MICAO	Mic amplifier output signal
CN20 (E/10)	1	GND	GND
	2	SP2	AF signal (PHONE use OFF)
	3	GND	GND
	4	MICAO	Mic amplifier signal input
	5	GND	GND
	6	MONVR2	Monitor signal input
CN21 (F/10)	1	GND	GND
CN22 (F/10)	1	K7	Key output 7 input
	2	K6	Key output 6 input.
	3	K5	Key output 5 input
	4	S6	Key matrix select signal 6 input.
CN23 (F/10)	1	AFTS	AF VBT switch "H" . ON
	2	NOTS	NOTCH switch. 'H" . ON
	3	NFM15	+15V (Except FM mode)

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN24 (G/10)	1	+15	+15V
CN25 (G/10)	1	SSBB	SSB voltage supply (+15V).
	2	PRCSW	Processor switch "H" ON
	3	GND	GND
	4	MPV	Mic volume signal/Processor IN signa. Processor switch ON . Processor IN
	5	NB2	Noise banker 2 switch.
	6	NB1	Noise banker 1 switch
	7	GND	GND
	8	+15	+15V
CN26 (G/10)	1	GND	GND
	2	PRCVR2	Processor IN signal
	3	GND	GND
	4	MICVR2	Mic volume output signal
CN27 (G/10)	1	NBV2	Main NB2 controlled voltage.
	2	SNBV2	Sub NB2 controlled voltage
	3	SNBV1	Sub NB1 controlled voltage.
	4	NBV1	Main NB1 controlled voltage
	5	GND	GND
	6	+15	+15V.
CN28 (G/10)	1	SNB2	Sub NB2 switch.
	2	SNB1	Sub NB1 switch.
CN29 (J/10)	1	5DG	+5V.
	2	MNS	AT manual/auto switch "L" Auto
	3	GND	GND
	4	PR2	AT VC2 preset data
	5	PR1	AT VC1 preset data
	6	BI	Dimmer controlled signal.
	7	LH	Dimmer controlled signal
CN30 (J/10)	1	GND	GND
	2	PRE1	Preset data 1
	3	PRE2	Preset data 2.
	4	GND	GND
CN31 (J/10)	1	DIM2	Dimmer signal output
	2	DIM1	Dimmer signal input.
CN32 (J/10)	1	CALS	Marker switch.
	2	GND	GND
	3	NC	Not used.
	4	CV2	CAR level volume
	5	CV1	CAR level volume
CN33 (C/10)	1	MONI	Monitor ON "H"
W1 (B/10)	1	MONI	Monitor. ON "H"
W2 (D/10)	1	MG	MIC GND
	2	MIC	MIC signal
	3	SS	Standby signal "L" TX
	4	GND	GND
	5	MD	MIC down signa.
	6	MU	MIC up signal
	7	8M	MIC +8V
W3 (G/10)	1	K0	Key output 0. SW ON "L"
	2	S5	Key matrix select signal 5. "L" Select
W4 (K/10)	1	SNBV1	Sub NB1 controlled voltage
	2	NBV2	Main NB2 controlled voltage.
	3	NBV1	Main NB1 controlled voltage.
	4	GND	GND
	5	SNBV2	Sub NB2 controlled voltage
	6	+15	+15V.

Connector No.	Terminal No.	Terminal Name	Terminal function
SWITCH UNIT (B) (X41-3090-00)			
CN1 (A/10)	1	SQ1	Squelch volume input except FM mode
	2	SQ2	Squelch volume output except FM mode
	3	FSQ2	Squelch volume input with FM mode
	4	FSQ1	Squelch volume output with FM mode.
	5	GND	GND
	6	NOV2	Notch volume output
	7	NOTS	Notch volume input.
CN2 (B/10)	1	SUBVR2	Sub AF volume output.
	2	GND	GND
	3	SUBVR1	Sub AF volume input.
	4	GND	GND
CN3 (B/10)	1	PITVR	Reference voltage (Pitch)
	2	PIT	CW pitch volume
	3	AGND	Analog GND
CN4 (C/10)	1	+15	+15V
	2	ATT1	10dB ATT controlled signal.
	3	ATT2	20dB ATT controlled signal
CN5 (D/10)	1	AGS	AGC select switch
	2	MID	AGC time constant MID select signal
	3	SLOW	AGC time constant SLOW select signal
	4	AGO	AGC OFF
CN6 (F/10)	1	REN2	RIT encoder output 2
	2	GND	GND
	3	REN1	RIT encoder output 1.
CN7 (G/10)	1	GND	GND
	2	MAINVR2	Main AF volume output
	3	GND	GND
	4	MAINVR1	Main AF volume input.
CN8 (G/10)	1	RFB2	RF GAIN volume output
	2	RFB1	RF GAIN volume input
CN9 (H/10)	1	SP1	Speaker 1 (AF signal hot side)
	2	GND	GND
	3	SP2	AF signal (Circuit will opened when PHONE plug is inserted.)
	4	GND	GND
	5	SP2	AF signal (Circuit will opened when PHONE plug is inserted.)
	6	GND	GND
CN10 (E/10)	1	GND	GND
	2	CEN1	Click encoder output 1
	3	CEN2	Click encoder output 2.
CN11 (J/10)	1	AFVBT1	AF VBT volume
	2	AFVBT2	AF VBT volume
	3	NC	Not used
	4	AGND	Analog GND
	5	VBT	VBT volume
	6	VRE3	Reference voltage 3
CN12 (K/10)	1	SLL	Slope tune low cut volume
	2	AGND	Analog GND
	3	SLH	Slope tune high cut volume
	4	VRE1	Reference voltage 1.
	5	VRE2	Reference voltage 2.
CN13 (K/10)	1	REF4	Reference voltage 4.
	2	PITVR	Reference voltage (Pitch)
W1 (K/10)	1	GND	GND

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
AVR UNIT (X43-3070-01)			
CN1 (A/5)	1	FG2	GND
	2	F15	Final unit +15V output
	3	F15	Final unit +15V output
CN2 (A/5)	1	+MT1	Power supply fan (+)
	2	-MT1	Power supply fan (-)
CN3 (A/5)	1	+MT2	Transformer fan (+)
	2	-MT2	Transformer fan (-)
CN4 (A/5)	1	15SG	Signal unit +15V output
	2	GND	GND
	3	-12SG	Signal unit -12V output
CN5 (A/5)	1	TPT	Approx. 5V output when decrease a RF output (power down)
	2	GND	GND
	3	15CN	Control unit +15V output
	4	AF15	Control unit +15V output (For AF amplifier µPC2002)
	5	-12CN	Control unit -12V output
CN6 (A/5)	1	5PL	PLL unit +5V output
	2	15PL	PLL unit +15V output
	3	GND	GND
	4	5DG	Digital unit +5V output
	5	GND	GND
	6	5DS	Display unit +5V output
	7	15DS	Display unit +15V output
	8	GND	GND
CN7 (D/5)	1	F	Display unit heater voltage input (FG GND AC 4.9V)
	2	FG	Display unit heater GND
	3	F	Display unit heater voltage input (FG GND AC 4.9V)
CN8 (A/5)	1	5DM	DSP unit +5V output
	2	5GND	GND
	3	15DM	DSP unit +15V output
	4	15GND	GND
	5	-12DM	DSP unit -12V output,
	6	NC	GND
CN9 (C/5)	1	FG1	Final unit GND
	2	FG1	Final unit GND
	3	FHV	Final unit +68V output
	4	FHV	Final unit +68V output
CN10 (A/5)	1	GND	GND
	2	GND	GND
	3	CO	+15V power supply input
	4	CO	+15V power supply input.
CN11 (B/5)	1	HV	Display unit -40V output
	2	HG	GND
	3	NC	GND
CN12 (B/5)	1	GND	GND
	2	-12	Each unit -12V output
CN13 (B/5)	1	AC40	-40V power supply input.
	2	AC40	-40V power supply input
	3	AC12	-12V power supply input.
	4	AC12	-12V power supply input
CN14 (D/5)	1	F	Display unit heater voltage output (FG GND AC 4.9V)
	2	FG	Display unit heater GND
	3	F	Display unit heater voltage output (FG GND AC 4.9V)

Connector No.	Terminal No.	Terminal Name	Terminal function
W1 (A/5)	1	GND	GND
	2	-12	Each unit -12V input.
W2 (C/5)		G	GND
		G	GND
		CO	+15V power supply output
		CO	+15V power supply output
W3 (A/5)		BB	+15V power supply bias input
W4 (A/5)	1	S1	Thermal switch + for power supply heat sink
	2	S2	Thermal switch - for power supply heat sink
W5 (A/5)	1	SCRA	SCR unit (X58-3730-00) input
(D/5)		BB	+15V power supply bias output
(B/5)		AC-L	Ac live (AC hot side)
(B/5)		AC-N	AC neutral (AC GND side)
		PWR-C	Power switch common
(B/5)		PWR-M	Power switch make.
(B/5)		T-L	Power transformer live
(B/5)		T-N	Power transformer neutran
RF UNIT (X44-3100-00)			
CN1		TIF	Transmit IF signal (73.05MHz)
CN2	1	MKR	Marker signal
	2	GND	Maker signal GND
CN3		MVCO	Main LO1 input (73.06~103.05MHz)
CN4		SVCO	Sub LO1 input (40.065~70.055MHz)
CN5	1	TF3	Transmit BPF select signal (14.5~30MHz)
	2	TF2	Transmit BPF select signal (7.5~14.5MHz)
	3	TF1	Transmit BPF select signal. (0.01~7.5MHz)
	4	GND	GND
CN6	1	IPO	AIP (advanced Intercept Point) controlled signal
	2	RB0	Receive band information
	3	RB1	Receive band information.
	4	RB2	Receive band information
	5	RB3	Receive band information
	6	NC	Not used
CN7		MIF	Main IF signal (73.05MHz)
CN8		DRV	Transmit drive output.
		RAT	Receive antenna input
CN9	1	ATT1	Active 'H' 10dB ATT level when receive ATT signal
	2	ATT2	Active 'L' 20dB ATT level when receive ATT signal
	3	+15	+15V
	4	PCV	Gain variable voltage for power control
CN10		SIF	Sub IF signal
W4	1	GND	GND
	2	MOS	+15V when monitor operates
	3	ATS	+15V when AT TUNE operates
	4	AGC	RF AGC control signal
	5	TXB	+15V when transmit
	6	+15	+15V
	7	RXB	+15V when receive
FINAL UNIT (X45-3330-00)			
CN1	1	FG1	Final common.
	2	FG1	Final common
	3	FHV	+68V
	4	FHV	+68V
CN2	1	FG2	GND
	2	F15	+15V
	3	F15	+15V

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN3	1	TX.	Transm.t stopped
	2	TXB	+15V when transmit
	3	IC−	IC meter (−).
	4	IC+	IC meter (+)
CN4	1	NC	Not used
	2	TXB	+15V when transmit
	3	F15	+15V
CN5	1	MOT+	Fan motor (+)
	2	MOT−	Fan motor (−)
CN6		DRV	Drive signal input.
W1		PO	Final output.
DIGITAL UNIT (X46-3050-XX)			
CN1	1	5DG	+5V input.
	2	PRC	
	3	LTXB	Transmit LED signal input
	4	ESS	Personal computer interface transmission request signal output. Active "H"
	5	TXI	Transmission disable signal output
	6	CSS	Transmit/receive controlled signal input "L" : TX, "H" : RX
	7	NC	Not used
	8	DATC	DATA mode signal output. "L" : DATA mode
	9	NC	Not used.
	10	NC	Not used.
	11	ALMS	MET3 select signal output. "L" : ALC meter, "H" : Ic meter
	12	ATS	AT switch input
	13	ATA	AT AUTO input
	14	−12	−12V input
	15	+15	+15V input
	16	GND	GND
CN2	1	GND	
	2	PLE4	PLL controlled data enable 4 output
	3	PLE2	PLL controlled data enable 2 output
	4	PLE9	PLL controlled data enable 9 output
	5	PLE3	PLL controlled data enable 3 output
	6	PLE5	PLL controlled data enable 5 output
	7	PLE8	PLL controlled data enable 8 output
	8	PLE6	PLL controlled data enable 6 output.
	9	PLE7	PLL controlled data enable 7 output
	10	NC	Not used
	11	PDA	PLL controlled data output.
	12	PCK	PLL controlled data clock output
	13	MLE	DSP controlled data enable output (PLL)
	14	MEN	DSP controlled data enable output (DSP).
	15	MCK	DSP controlled data clock output (DSP, PLL)
	16	MDA	DSP controlled data output (DSP, PLL)
	17	UL2	Unlock signal input.
	18	UL3	Unlock signal input.
	19	FSKC	FSK mode signal output "H" : FSK mode
	20	SEL1	FSK controlled signal 1 output (shift width)
	21	SEL2	FSK controlled signal 2 output (shift width)
	22	SEL3	FSK controlled signal 3 output (shift direction)
	23	NC	Not used.
	24	GND	GND
CN3	1	GND	GND
	2	SSBC	SSB mode signal output. "L" : Mode select
	3	FMC	FM mode signal output "L" : Mode select
	4	CWC	CW mode signal output. "L" : Mode select
	5	AMC	AM mode signal output. "L" : Mode select

Connector No.	Terminal No.	Terminal Name	Terminal function
	6	FSKC	FSK mode signal output. "L" : Mode select
	7	DATC	DATA mode signal output. "L" : Mode select
	8	DB	DSP mounted signal input. "H" : Mounted
	9	LNOT	NOTCH LED signal input
	10	GND	GND
	11	SD	Serial/parallel conversion IC data output (TC9174F)
	12	STB	Serial/parallel conversion IC data enable output (TC9174F)
	13	SCK	Serial/parallel conversion IC data clock output (TC9174F)
	14	MOS	Transmit monitor switch input. "H" : Monitor ON
CN4	1	GND	GND
	2	NC	Not used.
	3	S6	Key matrix select signal 6 output "L" : Select
	4	S5	Key matrix select signal 5 output "L" : Select
	5	S4	Key matrix select signal 4 output "L" : Select
	6	S3	Key matrix select signal 3 output "L" : Select
	7	S2	Key matrix select signal 2 output "L" : Select
	8	S1	Key matrix select signal 1 output "L" : Select
	9	S0	Key matrix select signal 0 output. "L" : Select
	10	K7	Key input 7. "L" : SW ON
	11	K6	Key input 6 "L" : SW ON
	12	K5	Key input 5 "L" : SW ON
	13	K4	Key input 4 "L" : SW ON
	14	K3	Key input 3 "L" : SW ON
	15	K2	Key input 2. "L" : SW ON
	16	K1	Key input 1. "L" : SW ON
	17	K0	Key input 0 "L" : SW ON
	18	MU	MIC up signal input. "L" : SW ON
	19	MD	MIC down signal input. "L" : SW ON
	20	GND	GND
CN5	1	GND	GND
	2	FDT	FL tube and LED display data output
	3	FCK	FL tube and LED display data clock output
	4	FLE	FL tube and LED display data enable output
	5	FBY	FL tube and LED display data busy input "L" : Busy
	6	RES	Reset signal output "L" : Reset
	7	5DG	+5V
	8	LH	Dimmer controlled signal input (Latch)
	9	BI	Dimmer controlled signal output (Blanking)
	10	GND	GND
CN6	1	GND	GND
	2	NC	Not used
	3	VBD	PLL band information D output (VCO select of VCO1)
	4	VBC	PLL band information C output
	5	VBB	PLL band information B output
	6	VBA	PLL band information A output
	7	UL1	Unlock signal input
	8	PCK	PLL controlled data clock output.
	9	PDA	PLL controlled data output
	10	PLE1	PLL controlled data enable 1 output.
	11	PLE0	PLL controlled data enable 0 output.
	12	MABK	Main AF blanking output. "H" : Blanking
	13	SABK	Sub AF blanking output. "H" : Blanking
	14	GND	GND
CN7	1	5DG	+5V
	2	EN1	Main encoder pulse 1 input. (1 rotation 250 pulse)
	3	EN2	Main encoder pulse 2 input.
	4	GND	GND

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN8	1	CEN1	Click encoder pulse 1 input. } 1 rotation
	2	CEN2	Click encoder pulse 2 input } 25 pulse
	3	GND	GND
	4	REN1	RIT encoder pulse 1 input } 1 rotation
	5	REN2	RIT encoder pulse 2 input } 50 pulse
	6	GND	GND
CN9	1	NC	Not used
	2	RXD	Personal computer interface receive signal input
	3	TXD	Personal computer interface transmit signal output
	4	DGD	GND
	5	CTS	Personal computer interface transmission enable signal input.
	6	RTS	Personal computer interface reception enable signal output
	7	NC	Not used
CN10	1	MNS	AT manual/auto switch "L" : Auto, "H" : Manual
	2	PR2	AT VC2 preset data output.
	3	PR1	AT VC1 preset data output.
	4	5DG	+5V
	5	GND	GND
CN11	1	−12	−12V.
	2	OK	AT TUNE LED signal input
	3	APRE	AT manual/auto signal output. "L" : Auto, "H" : Manual
	4	VSWR	AT SWR D/A converter data output
	5	VREF	A/D converter reference voltage output (5V).
	6	AGND	Analog GND
	7	POD2	AT VC2 position volume signal input
	8	POD1	AT VC1 position volume signal input.
CN12	1	VRE3	A/D converter reference voltage output (5V).
	2	VBT	VBT volume input
	3	AGND	Analog GND
CN13	1	VRE2	A/D converter reference voltage output (5V)
	2	VRE1	A/D converter reference voltage output (5V)
	3	SLL	Slope tune low cut volume input
	4	SLH	Slope tune high cut volume input.
	5	AGND	Analog GND
CN14	1	RWM	Reflected wave voltage input
	2	MET3	ALC/Ic voltage input. ALMS "L" ALC "H" Ic
	3	MET1	Signal/RF voltage input. RX Signal, TX RF
	4	PRM	Processor meter voltage input.
	5	AGND	Analog GND
	6	AGND	Analog GND
CN15	1	VRE4	A/D converter reference voltage output (5V)
	2	PIT	PITCH volume input.
	3	AGND	Analog GND
	4	NC	Not used
CN16	1	BI	Dimmer controlled signal input (Blanking).
	2	LH	Dimmer controlled signal output (Latch).
CN17	1	GND	GND
	2	RB3	Receive band information 3 output.
	3	RB2	Receive band information 2 output
	4	RB1	Receive band information 1 output
	5	RB0	Receive band information 0 output
	6	HIPC	AIP ON/OFF signal output
CN18	1	GND	GND
	2	LP3	Transmit band information 3 output
	3	LP2	Transmit band information 2 output.
	4	LP1	Transmit band information 1 output.

Connector No.	Terminal No.	Terminal Name	Terminal function
	5	LP0	Transmit band information 0 output
CN19	1	LNOT	NOTCH LED signal output
	2	LTXB	Transmit LED signal output
	3	LMTA	AT-TUNE LED signal output
	4	HIPC	AIP LED signal output
CN20	1	5DG	+5V
	2	GND	GND
CN21	1	GND	GND
	2	SRBK	Sub RF blanking output. "H" Blanking
	3	MRBK	Main RF blanking output "H" Blanking
CN22	1	5DG	+5V
	2	SEN1	Sub encoder pulse 1 input } 1 rotation
	3	SEN2	Sub encoder pulse 2 input } 100 pulse
	4	GND	GND
CN23	1	SMG	Analog GND
	2	SMKR	SM-230 sub-marker data output
	3	RG0	SM-230 span switch input.
	4	RG1	SM-230 span switch input
	5	SMKC	SM-230 sub-marker controlled signal output. "L" : ON, "H" : OFF
	6	DGG	GND
	7	NC	Not used

IF UNIT (X48-3060-00)

CN1	1	88FC	2.7kHz filter select
	2	88FE	CW filter select
	3	88FD	1.8kHz filter select.
	4	88FB	AM filter select.
	5	88FA	FM filter select.
	6	MNG2	Main NB2 pulse input.
	7	MNG1	Main NB1 pulse input
	8	PSQ	Packet squelch
	9	STS	Sidetone switch
	10	NC	Not used.
CN2	1	SNB1	Sub NB1 switch
	2	SNB2	Sub NB2 switch
CN3	1	ALC	ALC voltage
	2	CKY	Keying controlled signal
	3	GND	GND
CN4		TIF	TX IF signal output (73.05MHz).
CN5		H642	Main LO2 input (64.22MHz).
CN6		MIF	Main 1st IF signal input (73.05MHz).
CN7		SUBIF	Sub 1st IF signal input (40.055MHz).
CN8	1	NB	Main NB signal output (8.83MHz).
	2	NBG	Main NB signal GND.
CN9		H507	Sub LO2 input (50.75MHz)
CN10	1	SRBK	Sub IF blanking.
	2	MRBK	Main IF blanking
CN11	1	GND	GND
	2	SP3	Speaker output. (AF output will opened when using EXT SP)
	3	GND	GND
	4	SP2	Speaker input.
CN12		PKSS	Packet stand-by switch
CN13	1	IFO2	IF OUT2 input (455kHz).
	2	GND	GND
CN14	1	SP1	Speaker input.
	2	GND	GND
	3	SS	Stand-by switch.
	4	RAL	External ALC.

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
	5	EKS	E ectric key sw tch
	6	COM	Paddle common.
	7	DOT	Paddle dot input.
	8	DASH	Paddle dash input
	9	KSW	Key switch.
CN15	1	SANO	Sub audio input.
	2	GND	GND
	3	MANO	Main audio input
	4	GND	GND
	5	ANI	Rear panel MIC signa output
	6	GND	GND
	7	SAF	Sub detect on output.
	8	GND	GND
CN16	1	C107	Sub CAR input (10 695MHz).
	2	GND	GND
	3	GND	GND
CN17	1	TR455	TX/RX 455kHz IF IN/OUT.
	2	GND	GND
CN18	1	GND	GND
	2	GND	GND
	3	H928	Main LO3 input (9 825MHz)
W1	1	GND	GND
	2	AGC	AGC voltage.
	3	NC	Not used
	4	RXB	15V when receive
	5	TXB	15V when transmit.
	6	−12	−12V.
	7	+15	+15V
	8	SMET	Ana og S-meter
AF UNIT (X49-3020-00)			
CN1	1	MNG1	NB1 gate controlled signal.
	2	MNG2	NB2 gate controlled signal
	3	SQ	Squelch signal
	4	STS	Sidetone switch
	5	RXB	+15V when receive
	6	TXB	+15V when transmit
	7	DB	DSP ON signal.
	8	FSKC	FSK mode controlled signal
	9	CWC	CW mode controlled signal
	10	FMC	FM mode contro ed signal.
	11	SSBC	SSB mode controlled signal
	12	FMNC	FM NARROW mode contro ed signal
	13	−12	−12V.
	14	+15	+15V.
CN2	1	NB	Main NB signal output (8 83MHz).
	2	NBG	Main NB signal GND
CN3	1	GND	GND
	2	SANO	Sub audio output
	3	GND	GND
	4	MANO	Main audio output
	5	GND	GND
	6	SAF	Sub detection nput.
CN4	1	GND	GND
	2	DAF2	DSP AF nput
	3	GND	GND
	4	DAF1	DSP AF output.
CN5	1	GND	GND
	2	AFVBT1	AF VBT volume
	3	AFVBT2	AF VBT volume.
	4	GND	GND

Connector No.	Terminal No.	Terminal Name	Terminal function
CN6	1	AFT	AF TUNE clock pulse (80kHz ± 50kHz)
	2	GND	GND
CN7	1	NB1	Noise blanker 1 switch
	2	NB2	Noise blanker 2 switch
	3	MON	Monitor switch.
	4	+15	+15V
	5	GND	GND
CN8	1	MONVR2	Monitor signal input.
	2	GND	GND
	3	AVR2	ANTI VOX controlled voltage nput
	4	GND	GND
	5	VOXDL	VOX delay controlled voltage input
	6	GND	GND
	7	VOXVR2	VOX GAIN contro ed voltage input
	8	GND	GND
CN9	1	+15	+15V
	2	15S	+15V switch
CN10	1	RBC	Rece ve t ming contro led signal
	2	VOXQ	VOX delay signal
	3	KEY	KEY signal
	4	CWB	CW voltage supply +15V.
CN11	1	AF	Audio signa output.
	2	GND	GND
	3	NC	Not used
CN12	1	GND	GND
	2	MICA0	MIC amplifier signal input
	3	NC	Not used.
	4	MOVR1	Monitor signal output.
	5	GND	GND
CN13	1	GND	GND
	2	MAINVR2	Main AF volume input.
	3	GND	GND
	4	SUBVR2	Sub AF volume input.
CN14	1	NC	Not used
	2	MAINVR1	Main AF volume output
	3	NC	Not used.
	4	SUBVR1	Sub AF volume output.
CN15	1	TON	Repeater tone input.
	2	GND	GND
CN16	1	GND	GND
	2	SABK	Sub AF blanking input
	3	MABK	Main AF blanking input.
	4	PLE0	PLL controlled data enable 0 input.
	5	PLE1	PLL controlled data enable 1 input.
	6	PDA	PLL controlled data input
	7	PCK	PLL controlled data clock input.
	8	UL1	Unlock detection signal output.
	9	VBA	PLL band information A
	10	VBB	PLL band information B
	11	VBC	PLL band information C.
	12	VBD	PLL band information D.
	13	NC	Not used
	14	GND	GND
CN17	1	VBD	VCO select signal (VCO7)
	2	VBC	VCO select signal (VCO7)
	3	VBB	VCO select signal (VCO7).
	4	VBA	VCO select signal (VCO7).
	5	GND	GND
CN18	1	10VCO	PLL reference signal (10MHz).
	2	GND	GND

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN19		H642	Main LO2 output (64.22MHz).
CN20		_O	PL_1 loop IF nput (35 05~35 55MHz)
CN21		AFTSW	AF VBT ON/OFF controlled nput
W1	1	GND	GND
	2	SCAF	Main SSB, CW AF input
	3	GND	GND
	4	FAAF	Main FM, AM AF nput.
	5	GND	GND
W2	1	TF3	Transmit BPF select signal (14.5~30MHz)
	2	TF2	Transmit BPF select signal (7 5~14 5MHz)
	3	TF1	Transmit BPF select signal (0 01~7 5MHz)
	4	GND	GND
W3		MVCO	Main LO1 output (73 06~103 05MHz)
PLL UNIT (X50-3100-00)			
CN1	1	GND	GND
	2	NC	Not used.
	3	SEL3	Keying pole (shift direct on) select signa .
	4	SEL2	Space frequency select signal
	5	SEL1	Space frequency select signa
	6	FSKC	FSK mode controlled signal
	7	UL3	Unlock detect on s.gna (Sub LO).
	8	UL2	Unlock detection signal (Ma n LO, CAR)
	9	MDA	PLL, DSP data.
	10	MCK	PL_, DSP data clock
	11	MEN	DSP command enable
	12	M_E	PLL data enable (DSP).
	13	PCK	P_L data clock.
	14	PDA	PLL data.
	15	NC	Not used
	16	PLE7	PL_ data enable (PL_7).
	17	P_E6	PLL data enable (PL_6).
	18	PLE8	PLL data enable (PL_8)
	19	PLE5	PLL data enable (PLL5).
	20	PLE3	PLL data enable (PLL3).
	21	PLE9	PLL data enable (PLL9)
	22	PLE2	PLL data enable (PLL2).
	23	PLE4	PL_ data enable (PLL4)
	24	GND	GND
CN2	1	VBD	VCO select s gnal (VCO7)
	2	VBC	VCO select signa (VCO7)
	3	VBB	VCO select signal (VCO7).
	4	VBA	VCO select signal (VCO7).
	5	GND	GND
CN3	1	PDA	P_L data.
	2	PCK	P_L data clock.
	3	PLE6	PLL data enab e (P_L6).
	4	PLE5	PLL data enable (PLL5)
	5	PLE9	PL_ data enable (PL_9)
	6	P_E4	PLL data enable (PL_4)
	7	UL4	Unlock detection signal.
CN4	1	MDA	PLL, DSP data.
	2	MCK	PLL, DSP data clock.
	3	MEN	DSP command enable
	4	MLE	PLL data enable (DSP)
	5	GND	GND
CN5	1	15PL	+15V.
	2	5PL	+5V
	3	GND	GND
CN6	1	GND	GND
	2	5PL	+5V

Connector No.	Terminal No.	Terminal Name	Terminal function
	3	15P_	+15V
	4	8PL	+8V
CN7		LO	PL_1 oop IF output (35 05~35 55MHz)
CN8		SVCO	Sub LO1 output (40 065~70 055MHz,
CN9		H507	Sub _O2 output (50 75MHz)
W1	1	FSKC	FSK mode controlled s gnal
	2	SEL1	Space frequency se ect signa
	3	SEL2	Space frequency select s gna
	4	SE_3	Keying po e (shift d.rect.on) se ect s gnal
W2		20M	Reference signa. (20MHz)
CAR UNIT (X50-3110-XX)			
CN1	1	C355	Main LO4 output (355kHz)
	2	GND	GND
	3	H928	Main LO3 output (9 285MHz).
	4	GND	
CN2	1	AFT	AF TUNE clock (80kHz ± 50kHz)
	2	GND	GND
CN3	1	C107	Sub CAR output (10 7MHz)
	2	GND	GND
	3	C100	Main CAR output (100kHz).
	4	GND	GND
CN4	1	10M	PL_ reference signal (10MHz)
	2	GND	GND
	3	NC	Not used.
CN5	1	10VCO	P_L reference signa (10MHz)
	2	GND	GND
CN6	1	FSKC	FSK mode control ed signa..
	2	SEL1	Space frequency select signal
	3	SEL2	Space frequency select signal
	4	SEL3	Keying pole (shift d rection) se.ect s gnal.
CN7	1	AFSK	FSK mark, space signal.
	2	GND	GND
	3	NC	Not used
CN8	1	RTTY	FSK KEY
	2	GND	GND
CN9	1	CALS	MKR switch.
	2	GND	GND
CN10		20M	Reference s gnal (20MHz)
CN11	1	MKR	MKR signal (500kHz)
	2	NC	Not used.
CN12	1	DGG	D gital GND
	2	SMKC	Sub marker contro.
	3	RG1	Monitor scope SPAN switch.
	4	RG0	Monitor scope SPAN switch
	5	SMKR	Sub marker voltage
	6	SMG	Analog GND
CN13	1	GND	GND
	2	RTS	Transmit request output.
	3	CTS	Transmit possib.e input
	4	DGG	Signal GND
	5	TXD	Transmit data output
	6	RXD	Receive data input
	7	GND	GND
W1	1	PDA	PLL data
	2	PCK	PLL data clock
	3	PLE6	PLL data enable (PLL6)
	4	P_E5	P_L data enable (PLL5)
	5	P_E9	P_L data enab e (PL_9)
	6	PLE4	P_L data enab.e PL_4).

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
	7	UL4	Unlock detection signa
W2	1	GND	GND
	2	5PL	+5V.
	3	15PL	+15V
	4	8PL	+8V
J1		EXT STD	External reference input (10kHz, 1Vp-p/600Ω)
J2		RKEY	FSK KEY
J3	1	SMG	Analog GND
	2	SMKC	Sub marker control
	3	RG1	Monitor scope SAPN switch
	4	NC	Not used
	5	RG0	Monitor scope SPAN switch.
	6	NC	Not used.
	7	SMKR	Sub marker voltage
	8	DGG	Digital GND
J4	1	GND	GND
	2	TXD	Transmit data output.
	3	RXD	Receive data input
	4	CTS	Transmit possible input.
	5	RTS	Transmit request output
	6	NC	Not used
FILTER UNIT (X51-3060-XX)			
CN1		AT1	AT input
CN2		AT2	AT output
CN3	1	RANT	Receive antenna
	2	GND	GND
CN4		PO	Filter input
CN5	1	GND	GND
	2	F15	+15V
	3	F5	+5V
CN6	1	VSR	Reflector detection
	2	GND	GND
	3	GND	GND
	4	VSF	Forward detection.
	5	PD	Power output drop
CN7	1	10A	7.5~10.5MHz (AT coiltap band information)
	2	25A	21.5~24.5MHz
	3	28A	24.5~30MHz.
	4	7A	4~7.5MHz
	5	18A	14.5~18.5MHz
	6	21A	18.5~21.5MHz.
	7	4A	2.5~4MHz.
	8	14A	10.5~14.5MHz
	9	NC	Not used
	10	GND	GND
CN8	1	LP0	Filter select. (4 digit BCD input.)
	2	LP1	Filter select.
	3	LP2	Filter select.
	4	LP3	Filter select.
	5	GND	GND
W23	1	F15	+15V
	2	TXB	+15V when transmit
CONTROL UNIT (X53-3230-00)			
CN1 (A/3)	1	GND	GND
	2	GND	GND
	3	BZ	Beep level input.
CN2 (A/3)	1	GND	GND
	2	VO	Voice synthesizer signal.

Connector No.	Terminal No.	Terminal Name	Terminal function
CN3 (A/3)	1	GND	GND
	2	AF	Audio signal input.
CN4 (A/3)	1	NC	Not used
	2	CWB	CW mode voltage supply
	3	VOXQ	VOX DELAY signal
CN5 (A/3)	1	KEY	KEY signal.
	2	RBC	Receive timing controlled signal
CN6 (A/3)	1	SP1	AF signal output
	2	GND	GND
CN7 (A/3)	1	TPT	Temperature power down voltage +5V
	2	−12CN	−12V for control unit
	3	15CN	+15V for control unit
	4	AF15	Voltage supply +15V for audio amplifier
	5	GND	GND
CN8 (A/3)	1	ATS	AT switch.
	2	ATA	AT AUTO switch
	3	FULL	Full break-in signal
	4	VOX	VOX signal
	5	SS	Stand-by switch
	6	GND	GND
	7	+15	+15V
CN9 (A/3)	1	NC	Not used
	2	DATC	Data controlled signal
	3	SS	Stand-by switch
CN10 (A/3)	1	GND	GND
	2	SP1	Audio signal
	3	CKY	Keying control.
	4	SS	Stand-by switch
	5	ALC	ALC signal.
CN11 (A/3)	1	KSW	Key switch
	2	RAL	External ALC input.
	3	EKS	Electric key switch
CN12 (A/3)	1	KSP2	Electric keyer speed.
	2	KSP1	Electric keyer speed
	3	CWD	CW delay
	4	+15	+15V
CN13 (A/3)	1	TXB	Voltage supply for transmit (+15V)
	2	CKY	Keying controlled signal.
	3	NC	Not used
CN14 (A/3)	1	AGO	AGC OFF
	2	SLOW	AGC time constant SLOW select signal.
	3	MID	AGC time constant MID select signal.
	4	AGS	AGC switch
CN15 (A/3)	1	TXB	Voltage supply for transmit (+15V)
	2	TX.	Transmit stop signal
	3	IC−	Collector current (−) signal
	4	IC+	Collector current (+) signal.
CN16 (A/3)	1	NC	Not used
	2	NC	Not used.
	3	ATA	AT AUTO switch
	4	ATS	AT switch.
	5	NC	Not used
CN17 (A/3)	1	GND	GND
	2	VSR	Reflector voltage
CN18 (A/3)	1	AGND	GND
	2	AGND	GND
	3	PRM	Processor meter
	4	MET1	Meter signal input.
	5	MET3	Meter signal.
	6	RWM	SWR meter signal

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN19 (A/3)	1	GND	GND
	2	+15	+15V.
	3	−12	−12V
	4	ATA	AT AUTO switch
	5	ATS	AT switch
	6	ALMS	ALC meter switch
	7	NC	Not used
	8	NC	Not used.
	9	DATC	Data control ed signal
	10	NC	Not used.
	11	CSS	Stand-by control ed signal.
	12	TX.	Transmit stop s gna
	13	ESS	Personal computer interface STBY switch
	14	⊥TXB	ON AIR LED signal
	15	PROC	
	16	5DIG	+5V voltage supply for dig tal unit
CN20 (A/3)	1	RXB	Receive voltage supply +15V
	2	TXB	Transmit voltage supply +15V
	3	RBC	Receive tim ng controlled signal.
	4	PRS	Processor switch
	5	AGS	AGC switch.
	6	MID	AGC time constant MID select signal
	7	SLOW	AGC time constant SLOW select signal.
	8	AGO	AGC OFF
	9	SSBB	SSB mode voltage supply (+15V)
	10	PRM1	Processor meter signal nput
	11	GND	GND
	12	SMET	S-meter signa.
	13	NC	Not used
	14	D15	+15V supply when connect to DSP-10
CN21 (A/3)	1	8V	+8V
	2	ALCC	ALC signal connection.
	3	−12	−12V
	4	GND	GND
CN22 (A/3)	1	NC	Not used.
	2	MET1	Meter signal .nput
	3	TPT	Temperature power down voltage +5V
	4	ATS	AT switch.
	5	+15	+15V
	6	GND	GND
CN23 (A/3)	1	SSBB	SSB mode voltage supply (+15V)
	2	PRCSW	Processor switch
CN24 (B/3)	1	PD	Power output drop signal
	2	GND	GND
	3	VSF	Forward voltage.
CN25 (B/3)	1	GND	GND
	2	8V	+8V.
	3	POV3	Power output volume GND.
	4	POV2	Power output volume output
	5	POV1	Power output vo ume nput
CN26 (C/3)	1	COM	Paddle input common.
	2	DASH	Paddle dash input
	3	DOT	Paddle dot nput
CN27 (C/3)	1	EKS	Electric keyer switch
	2	KEY	Key signal (Key down 0V, Key up . 15V)
	3	FULL	Full break-in signal.
	4	CWB	CW mode voltge supply
	5	+5	+5V.
	6	GND	GND
CN28 (A/3)	1	EKS	Electric key switch
	2	KEY	Key signal (Key down . 0V, Key up : 15V).

Connector No.	Terminal No.	Terminal Name	Terminal function
	3	FULL	Full break-in signal.
	4	CWB	CW mode voltage supp.y
	5	+5	+5V
	6	GND	GND
CN29 (A/3)	1	NC	Not used
	2	KSP1	Electric keyer speed.
	3	KSP2	Electric keyer speed.
CN30 (C/3)	1	NC	Not used.
	2	KSP1	E ectric keyer speed.
	3	KSP2	Electr c keyer speed
CN31 (C/3)	1	GND	GND
	2	AUTO	AUTO waiting.
	3	REV	Reverse
	4	WT1	Wait ng (Manua setting 1)
	5	WT0	Waiting (Manual setting 0)
CN32 (C/3)		KEY	Key signal (Key down 0V, Key up · 15V)
CN33 (A/3)		KEY	Key signal (Key down 0V, Key up 15V).
W3 (A/3)	1	GND	GND
	2	AUTO	AUTO wa.ting.
	3	REV	Reverse
	4	WT1	Waiting (Manual setting 1).
	5	WT0	Wa ting (Manual setting 0).
W4 (B/3)	1	8V	+8V.
	2	ALCC	ALC signal connection.
	3	−12	−12V
	4	GND	GND
W5 (B/3)	1	NC	Not used.
	2	MET1	Meter s gnal
	3	ATS	AT switch
	4	TPT	Temperature power down voltage +5V
	5	GND	GND
	6	+15	+15V
AT UNIT (X53-3240-00)			
CN1		AT1	AT nput terminal
CN2		AT2	AT output terminal
CN3	1	VRE	+5V reverence
	2	POD2	Volume 2 output
	3	GND	GND
	4	POD1	Volume 1 output
CN4	1	NC	Not used.
	2	M2−	Motor 2 drive (−).
	3	M2+	Motor 2 dr ce (+)
	4	M1−	Motor 1 drive (−)
	5	M1+	Motor 1 dirve (+)
CN5	1	F5	+5V
	2	F15	+15V
	3	GND	GND
CN101	1	28A	24.5~30MHz
	2	25A	21.5~24 5MHz.
	3	21A	18 5~21.5MHz
	4	18A	14 5~18 5MHz.
	5	14A	10.5~14 5MHz
	6	10A	7 5~10 5MHz
	7	7A	4~7MHz
	8	4A	2 5~4MHz
	9	GND	GND
			AT coiltap band information
W1		VC1	VC1 hot side.

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
W2		VC2	VC2 hot side
W3		GND	GND
W4	1	OK	'H' when tuning
	2	VSWR	VSWR
	3	APRE	'L' when auto tuning
	4	VRE	+5V reference
	5	PRE1	Preset data 1
	6	PRE2	Preset data 2
	7	POD2	Position 2
	8	GND	GND
	9	GND	GND
	10	POD1	Position 1
	11	GND	Analog GND for digital unit
W5	1	ATA	AT AUTO switch
	2	ATS	AT switch
W101		VC	VC1, VC2 common side
W102		GND	GND
DSP UNIT (X53-3260-00)			
CN1	1	GND	GND
	2	DMIC	MIC input.
	3	DAF1	Audio input
	4	DAF2	Audio output
	5	GND	GND
	6	GND	GND
	7	DB	+15V
	8	D455	455kHz output
CN2	1	−12	−12V
	2	GND	GND
	3	GND	GND
	4	+15	+15V
CN3	1	10M	10MHz reference.
	2	GND	GND
CN4	1	GND	GND
	2	MIX	MIX
	3	GND	GND
	4	SH	Sample hold amplifier, sampling timing.
	5	LEC	D/A convert command
	6	CC	A/D convert command
	7	GND	GND
	8	ADDT	Data from A/D converter
	9	CK17	Serial clock
	10	DADT	Data to D/A converter
	11	GND	GND
	12	ANSW	D/A converter output duty adjust
	13	MOD2	LPF input mute.
	14	MOD0	DMIC-DAF1 select, DAF1-DAF2 through
	15	MOD1	ATT control
	16	+15A	+15V.
	17	+15A	+15V
	18	HPF1	HPF control
	19	HPF2	HPF control
	20	GND	GND
CN5	1	GND	GND
	2	HPF2	HPF control.
	3	HPF1	HPF control
	4	+15A	+15V
	5	+15A	+15V
	6	MOD1	ATT control
	7	MOD0	DMIC-DAF1 select, DAF1-DFA2 through.
	8	MOD2	LPF input mute
	9	ANSW	D/A converter output duty adjust

Connector No.	Terminal No.	Terminal Name	Terminal function
	10	GND	GND
	11	DADT	Data to D/A converter
	12	CK17	Serial clock
	13	ADDT	Data from A/D converter.
	14	GND	GND
	15	CC	A/D convert commamd.
	16	LEC	D/A convert command
	17	SH	Sample hold amplifier, sampling timing.
	18	GND	GND
	19	MIX	MIX.
	20	GND	GND
CN6	1	GND	GND
	2	5DMS	+5V voltage supply for digital section
	3	MLE	PLL data enable
	4	MEN	DSP command enable
	5	MCK	PLL, DSP data clock.
	6	MDA	PLL, DSP data
	7	RTTY	FSK, KEY
	8	CKY	CW KEY
	9	TXB	TX +15V
CN7	1	GND	GND
	2	CLK	Reference signal
	3	GND	GND
	4	+5	+5V
	5	MCK2	PLL data clock.
	6	MLE2	PLL data enable.
	7	MDA2	PLL data.
	8	+15B	+15V
W1	1	+15B	+15V
	2	MDA2	PLL data
	3	MLE2	PLL data enable
	4	MCK2	PLL data clock
	5	+5	+5V.
	6	GND	GND
	7	CLK	Reference signa
	8	GND	GND
DSPA	1	GND	GND
	2	5DMS	+5V voltage supply for digital section
	3	MLE	PLL data enable.
	4	MEN	DSP command enable
	5	MCK	PLL, DSP data clock
	6	MDA	PLL, DSP data
	7	RTTY	FSK KEY
	8	CKY	CW KEY
	9	TXB	TX +15V
	10	NC	Not used
	11	−12	−12V voltage supply for analog section
	12	GND	GND
	13	GND	GND
	14	+15	+15V voltage supply for analog section
	15	10DMS	Reference
	16	GND	10DMS GND
	17	NC	Not used.
	18	NC	Not used.
DSPB	1	GND	GND
	2	DMIC	MIC input.
	3	DAF1	Audio input.
	4	DAF2	Audio output.
	5	GND	GND
	6	GND	GND
	7	D455	455kHz IF output
	8	DB	Analog-DSP select signal

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
DISPLAY UNIT (X54-3080-00)			
CN1	1	5DG	+5V voltage supply for keyboard (+5V)
	2	TR	TX/RX signal input.
	3	LFM	FM mode LED output Active 'H'
	4	NC	Not used
	5	NC	Not used
	6	LAM	AM mode LED output Active 'H'
	7	LCW	CW mode LED output Active 'H'
	8	LUSB	USB mode LED output Active 'H'
	9	LLSB	LSB mode LED output. Active 'H'
	10	LFSK	FSK mode LED output. Active 'H'
	11	LTA	Function TX-A LED output Active 'H'
	12	LK1	Key top LED output Active 'H'
	13	LRM	Function RX-M LED output Active 'H'
	14	LRA	Function RX-A LED output Active 'H'
	15	LTM	Function TX-M LED output Active 'H'
	16	LTB	Function TX-B LED output Active 'H'
	17	LRB	Function RX-B LED output. Active 'H'
	18	GND	GND
CN2	1	TN1	67.0~250.3Hz repeater tone output
	2	GND	GND
CN3	1	TN2	1750Hz repeater tone output.
	2	GND	GND
CN4	1	BZ	Beep level output
	2	GND	GND
CN5	1	GND	GND
	2	BI	Dimmer blanking signal input
	3	LH	Dimmer controlled output
	4	5DG	+5V voltage supply input
	5	RES	Reset signal input "L" Reset
	6	FBY	Serial busy output "L" Busy
	7	FLE	Serial enable input
	8	FCK	Serial clock input
	9	FDT	Serial data input
	10	GND	GND
CN6	1	F	FL tube filament power supply input Between F to F. Approx. AC 9.6V
	2	FG	FL tube filament power supply output. Center tap DC bias Approx. −28V
	3	F	FL tube filament power supply input Between F to F Approx. AC 9.6V
	4	HV	FL tube drive voltage supply input (approx. −40V)
	5	HG	FL tube drive voltage supply GND
	6	15DS	FL tube drive voltage supply input (+15V)
	7	GND	GND
	8	5DS	FL tube drive voltage supply input (+5V)
CN7	1	SC	Voltage supply output for option VS-2.
	2	SD	Serial data output for option VS-2
	3	SCK	Serial clock output for option VS-2
	4	BSY	Busy input for option VS-2.
	5	STR	Start signal output for option VS-2
	6	GND	GND
SIGNAL UNIT (X57-3380-00)			
CN1	1	RXB	+15V when receive
	2	TXB	+15V when transmit
	3	RBC	Receive timing signal
	4	PRS	Processor switch
	5	AGS	+15V except data mode.
	6	MID	AGC time constant MID select signal
	7	SLOW	AGC time constant SLOW select signal
	8	AGO	AGC OFF signal
	9	SSBB	+15V when SSB mode
	10	PRM1	Compression meter voltage output
	11	GND	GND
	12	SMET	S meter voltage output
	13	NC	Not used.
	14	D15	+15V voltage supply output for DSP-10
CN2	1	MOS	Monitor switch
	2	CK	TC9174F clock signal
	3	STB	TC9174F strobe signal
	4	SD	TC9174F data signal
	5	GND	GND
	6	LNOT	NOTCH LED voltage
	7	DB	On signal for DSP-10
	8	DATAC	Data mode controlled signal
	9	FSKC	FSK mode controlled signal
	10	AMC	AM mode controlled signal
	11	CWC	CW mode controlled signal
	12	FMC	FM mode controlled signal
	13	SSBC	SSB mode controlled signal
	14	GND	GND
CN3	1	AFSK1	AFSK signal
	2	GND	GND
	3	MPV	MIC signal
	4	GND	GND
CN4	1	CV2	CAR volume 2
	2	CV1	CAR volume 1
CN5	1	GND	MIC GND for DSP-10.
	2	DMC	MIC signal for DSP-10
CN6	1	RFB1	RF GAIN reference voltage
	2	RFB2	GND
	3	PRL2	Processor level controlled signal
	4	GND	GND
CN7	1	GND	GND
	2	SCAF	Main band SSB and CW mode AF output
	3	GND	GND
	4	FAAF	Main band FM and AM mode AF output
	5	GND	GND
CN8	1	+15	+15V
	2	GND	GND
	3	−12	−12V
CN9	1	+15	+15V
	2	-12	-12V
	3	FMNC	FM NARROW mode controlled signal
	4	SSBC	SSB mode controlled signal
	5	FMC	FM mode controlled signal.
	6	CWC	CW mode controlled signal
	7	FSKC	FSK mode controlled signal.
	8	DB	On signal for DSP-10
	9	TXB	+15V when transmit
	10	RXB	+15V when receive
	11	STS	Sidetone switch
	12	SQ	Squelch signal
	13	NG2	NB2 gate controlled signal
	14	NG1	NB1 gate controlled signal
CN10	1	88FD	455kHz IF filter select signal.
	2	88FE	455kHz IF filter select signal
	3	88FC	455kHz IF filter select signal.
	4	88FB	455kHz IF filter select signal
	5	88FA	455kHz IF filter select signal.
	6	MNG2	NB2 gate controlled signal.
	7	MNG1	NB1 gate controlled signal.

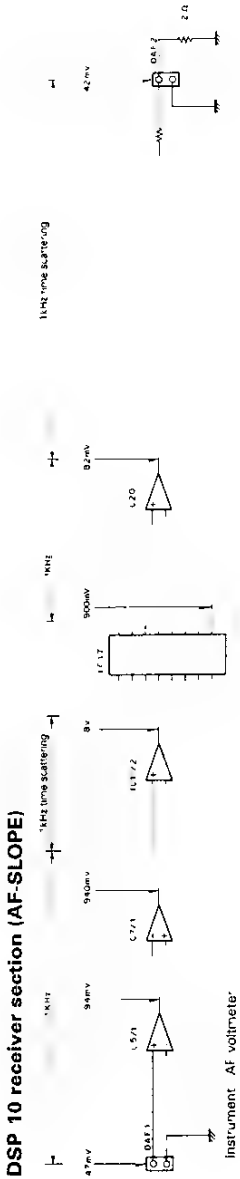
TERMINAL FUNCTION

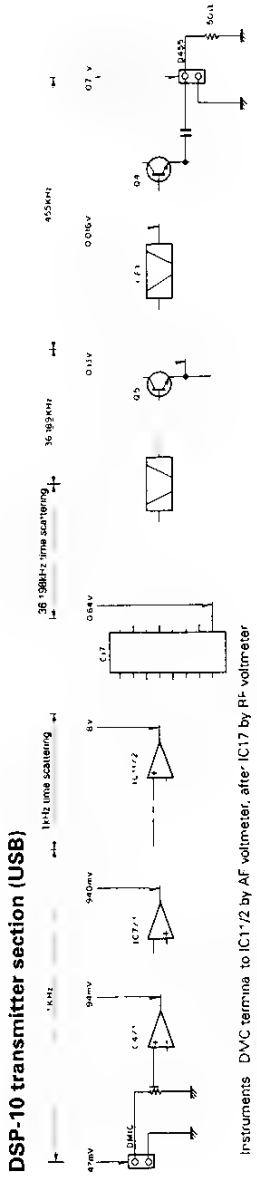
Connector No	Terminal No	Terminal Name	Terminal function
	8	SQ	Squelch signa
	9	STS	Sidetone switch
	10	NC	Not used
CN11	1	ATS	Antenna tuner switch
	2	MOS	Monitor switch
CN12	1	GND	GND
	2	ATS1	Antenna tuner switch
	3	MOS	Monitor switch
	4	AGC	AGC line
	5	TXB	+15V when transmit
	6	RXB	+15V when receive
	7	+15	+15V
CN13	1	AGC	AGC line
	2	MOS	Monitor switch
	3	RXB	+15V when receive
	4	TXB	+15V when transmit
	5	12	12V
	6	+15	+15V
	7	GND	GND
	8	SMET	S-meter voltage output

Connector No.	Terminal No	Terminal Name	Terminal function
CN14	1	NOTS	NOTCH switch
	2	NFM15	+15V except FM mode
	3	FSQ1	FM squelch volume 1
	4	FSQ2	FM squelch volume 2
	5	SQ2	CAR squelch volume 2
	6	NOTS	NOTCH switch
	7	NOV2	NOTCH volume 2
	8	SQ1	CAR squelch volume 1
	9	GND	GND
CN15	1	IFO2	IF OUT2 output
	2	GND	GND
CN16	1	C100	100kHz CAR input
	2	GND	GND
	3	C355	355kHz local input
	4	GND	GND
CN17	1	TR455	TX/RX 455kHz I/O
	2	GND	GND
CN18	1	DB	On signal for DSP 10
	2	GND	GND
	3	D455	455kHz input from DSP 10

TS-950S/SD

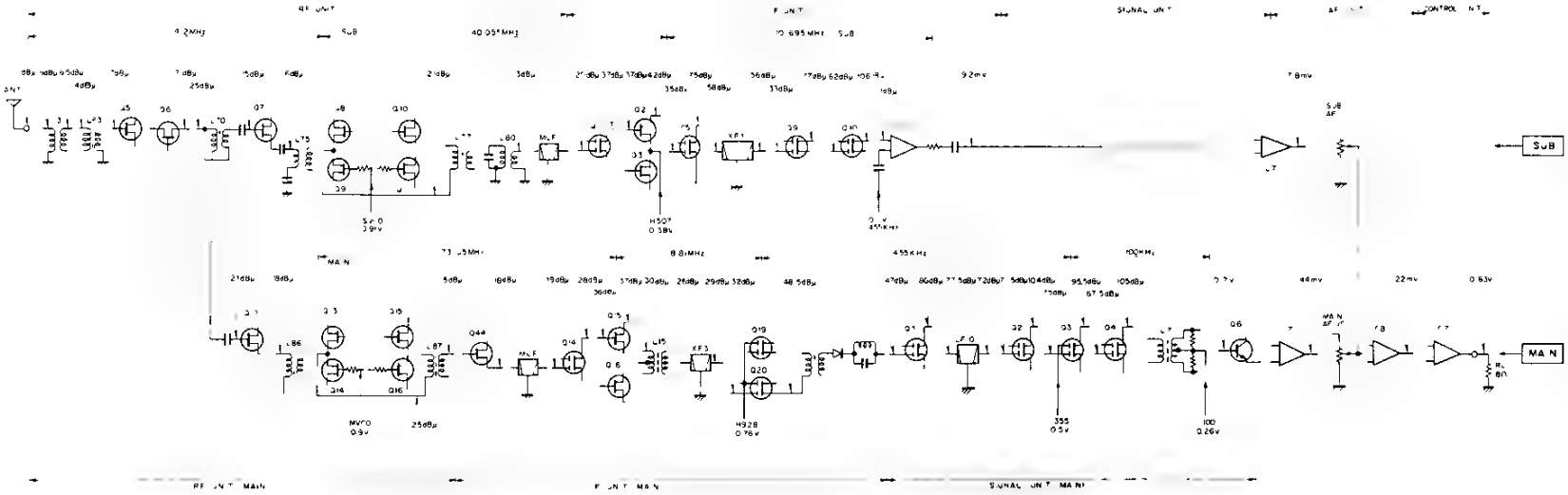
LEVEL DIAGRAM





LEVEL DIAGRAM

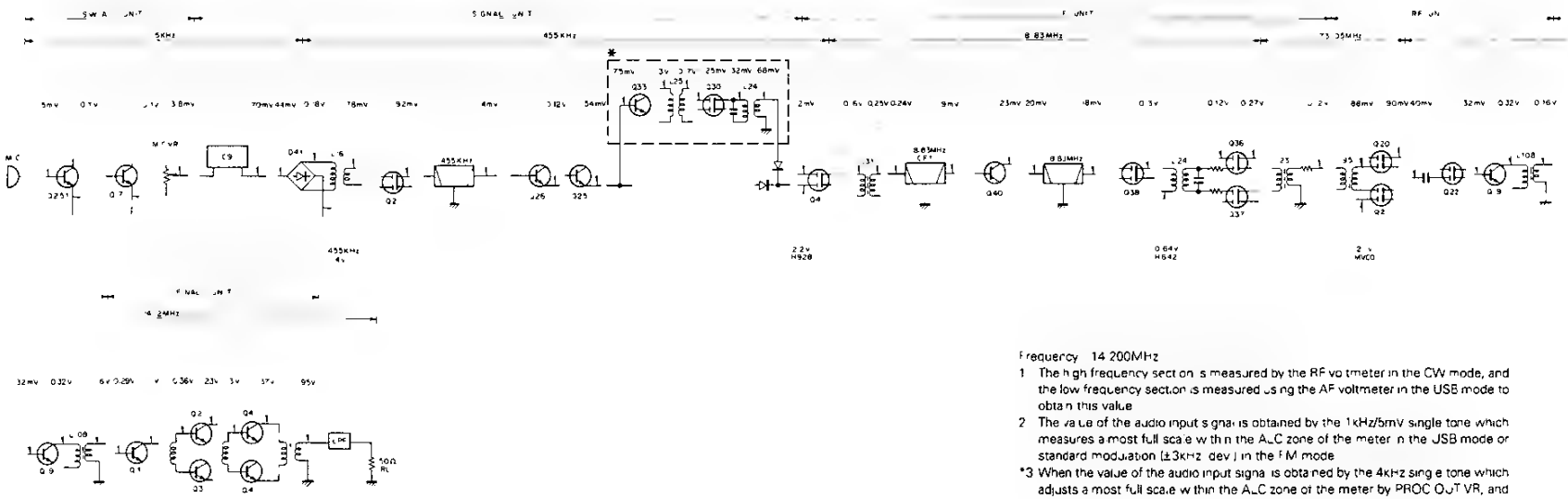
Receiver section



Frequency 14.200MHz
Input 0dBμ
AF output 0.63V/8Ω

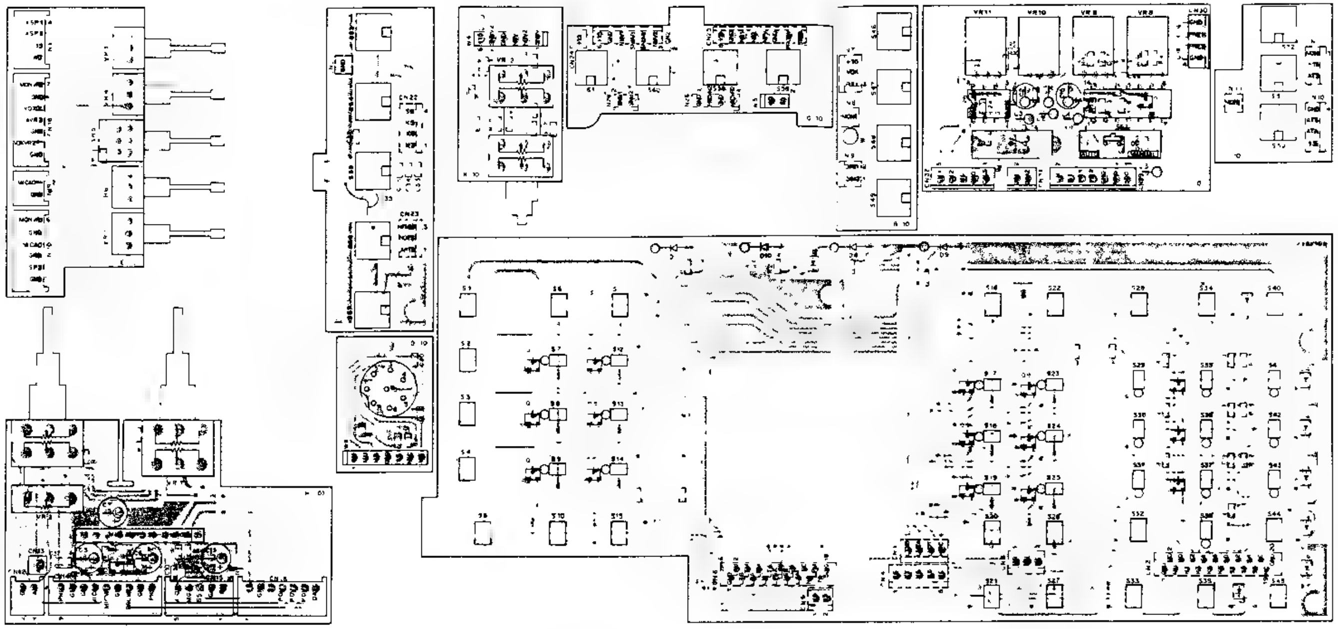
1 The figures shown are signal generator output required for a constant audio output with a constant AF gain control setting
Set the AF gain control for 0.63V 8Ω audio output at 0dBμ signal generator input at 14.200MHz
2 To measure signal generator output connect a 0.01μF capacitor between the signal generator and the check point
3 APF OFF

Transmitter section

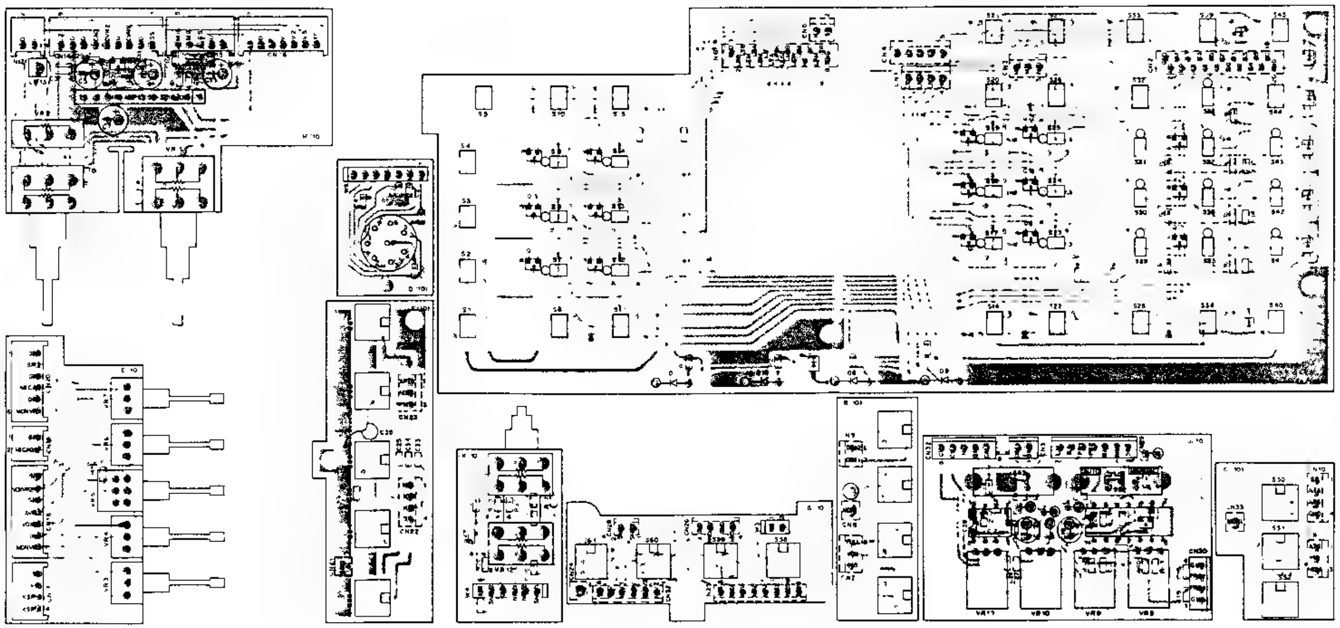


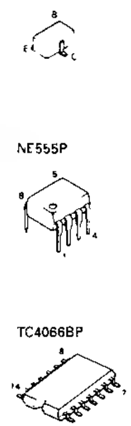
Frequency 14.200MHz
1 The high frequency section is measured by the RF voltmeter in the CW mode, and the low frequency section is measured using the AF voltmeter in the USB mode to obtain this value
2 The value of the audio input signal is obtained by the 1kHz/5mV single tone which measures almost full scale within the ALC zone of the meter in the USB mode or standard modulation (±3kHz deviation) in the FM mode
*3 When the value of the audio input signal is obtained by the 4kHz single tone which adjusts almost full scale within the ALC zone of the meter by PROC OUT VR, and also, adjust starting level within the COMP zone of the meter by PROC IN VR

SWITCH UNIT (A) (X41-3080-00) Component side view



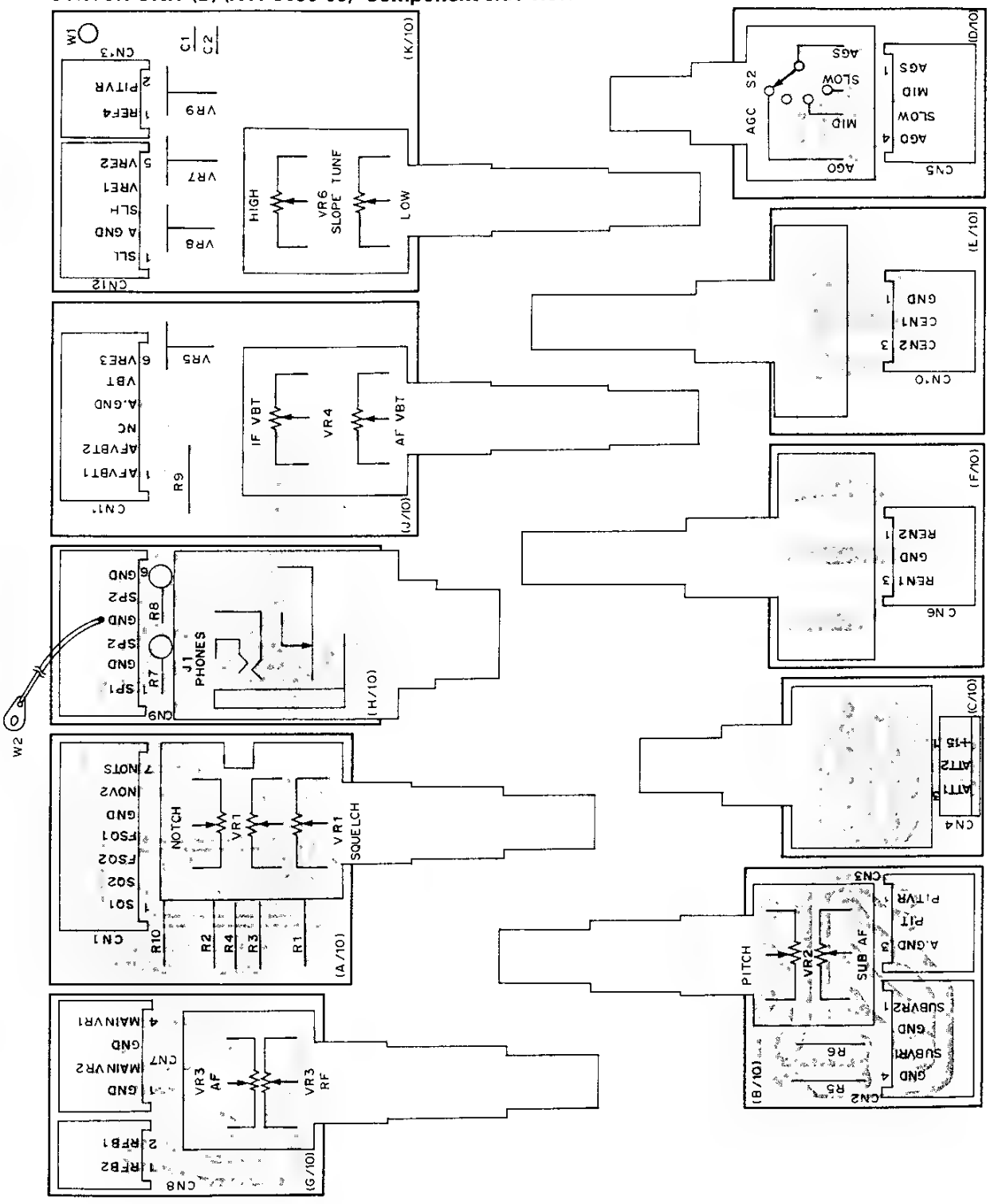
SWITCH UNIT (A) (X41-3080-00) Foil side view





TS-950S/SD PC BOARD VIEW / CIRCUIT DIAGRAM

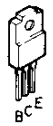
SWITCH UNIT (B) (X41-3090-00) Component side view



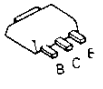
2SC2712
2SC3907
DTC114EK

2SA1358

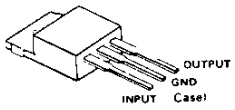
2SB941



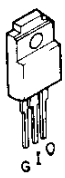
2SD1624S



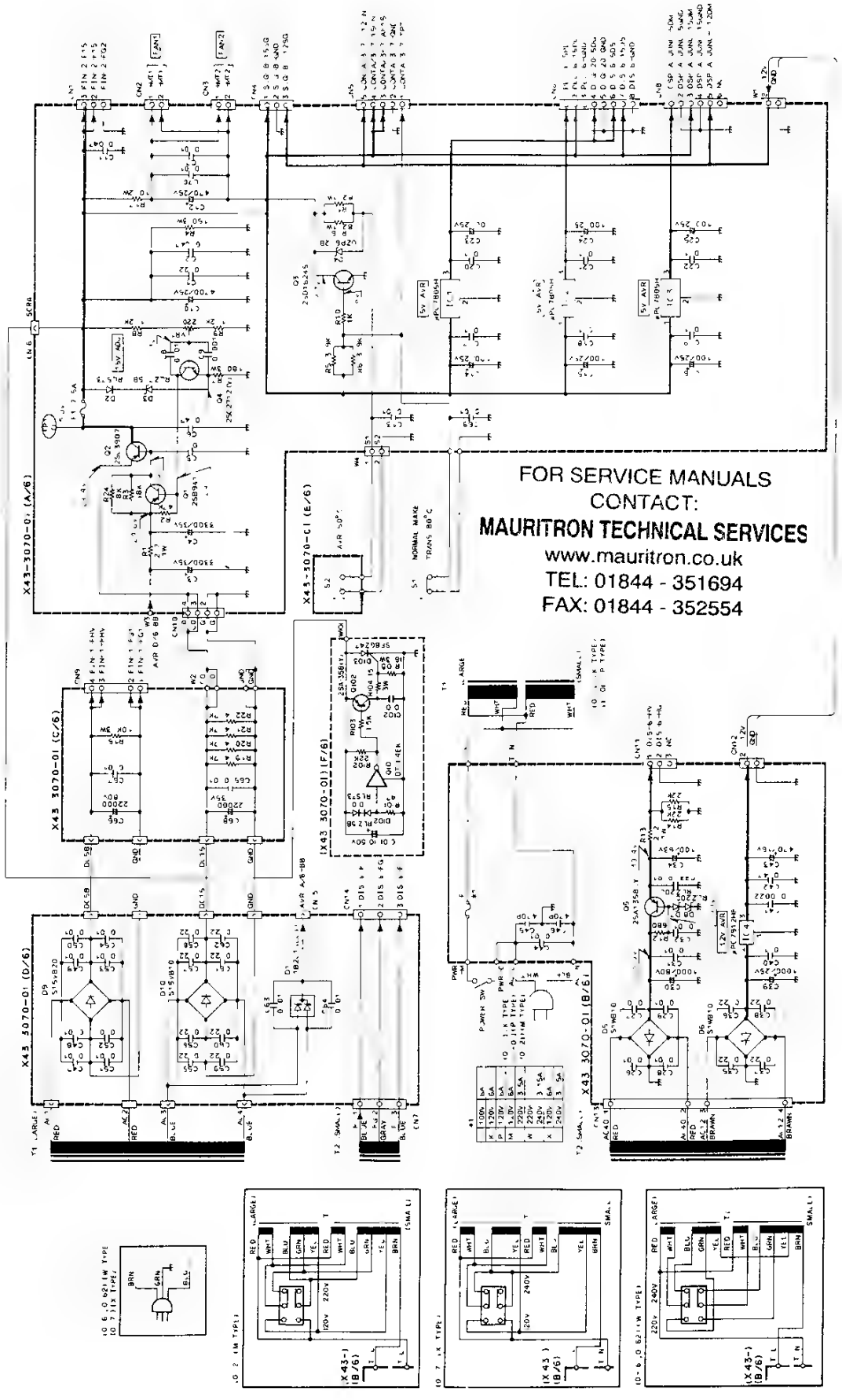
µPC7805H



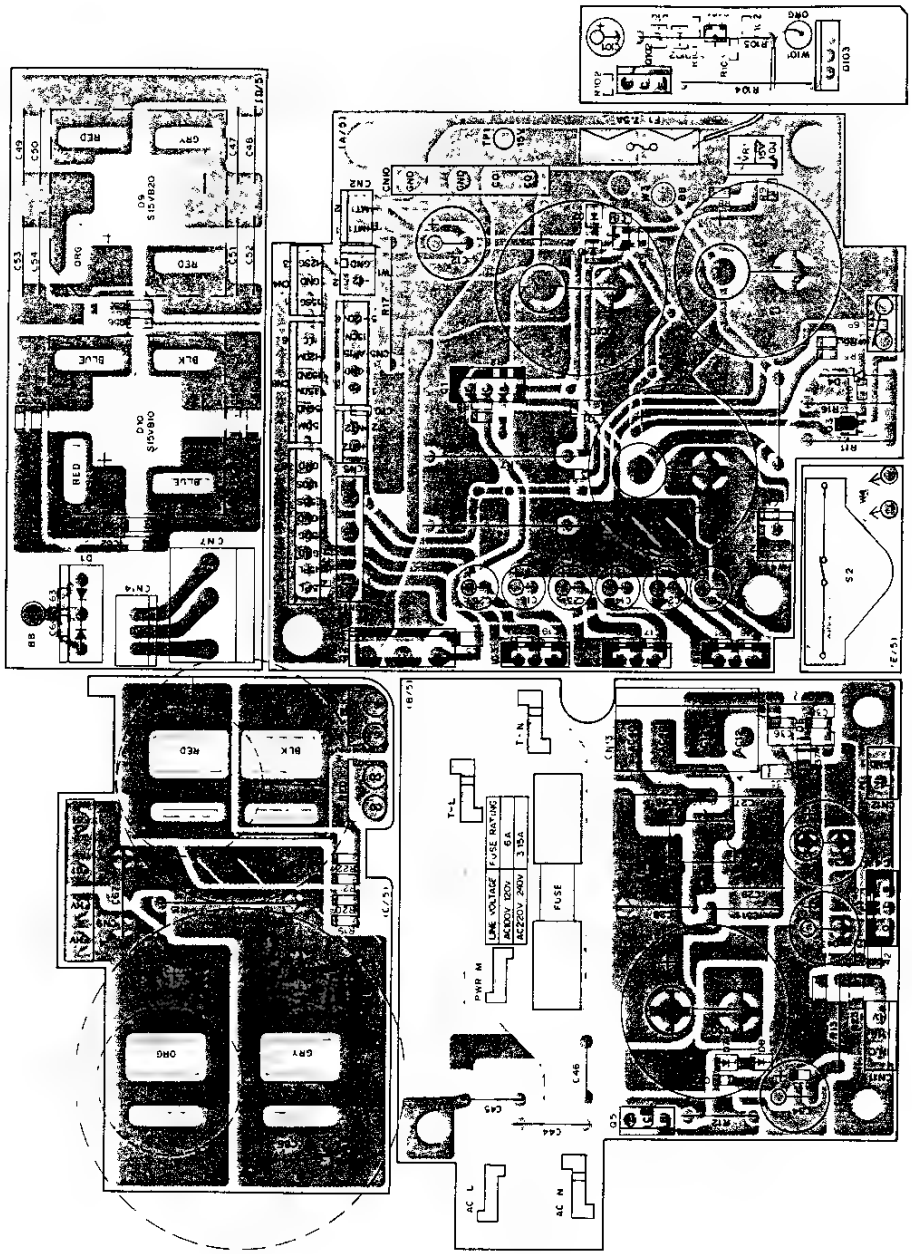
µPC7912HF



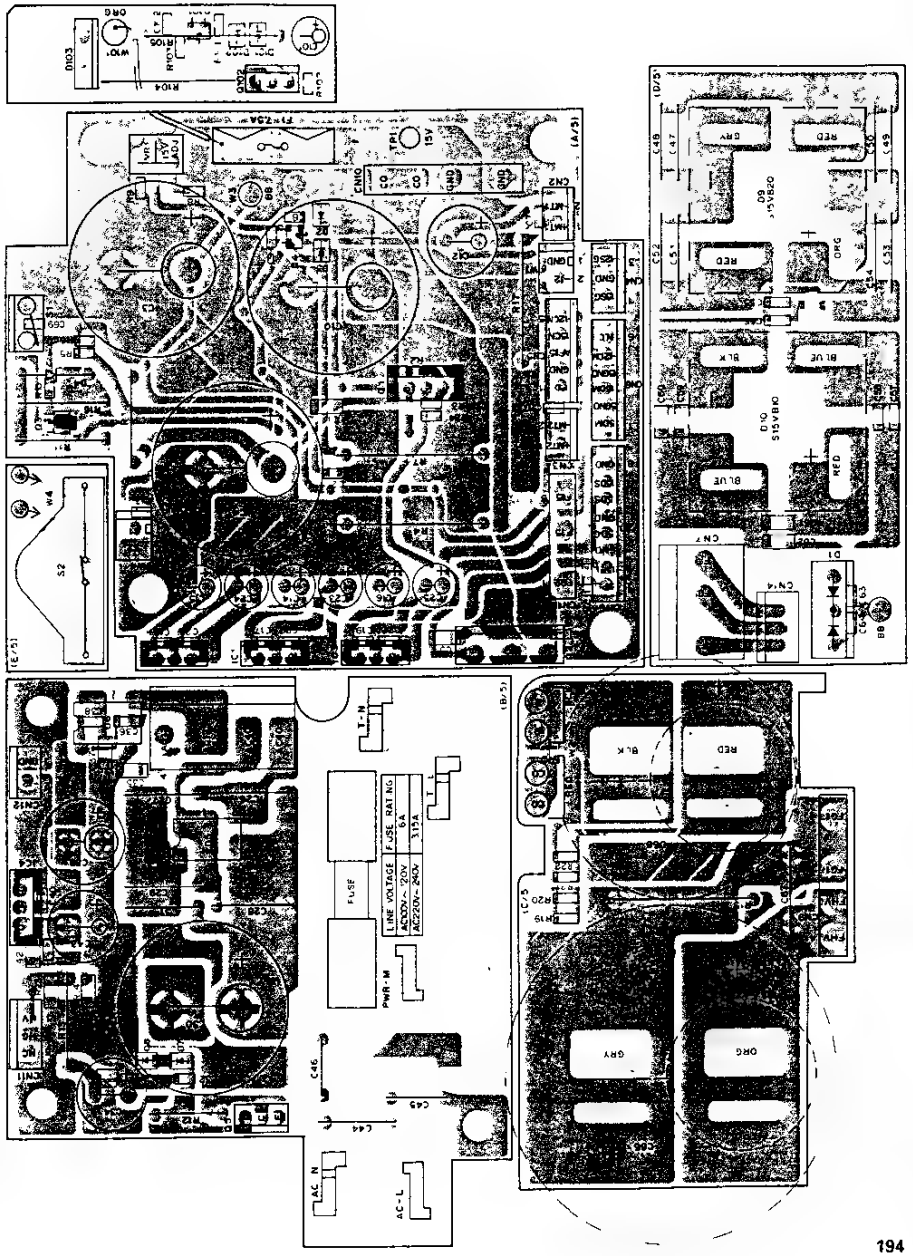
AVR UNIT (X43-3070-01)



AVR UNIT (X43-3070-01) Component side view

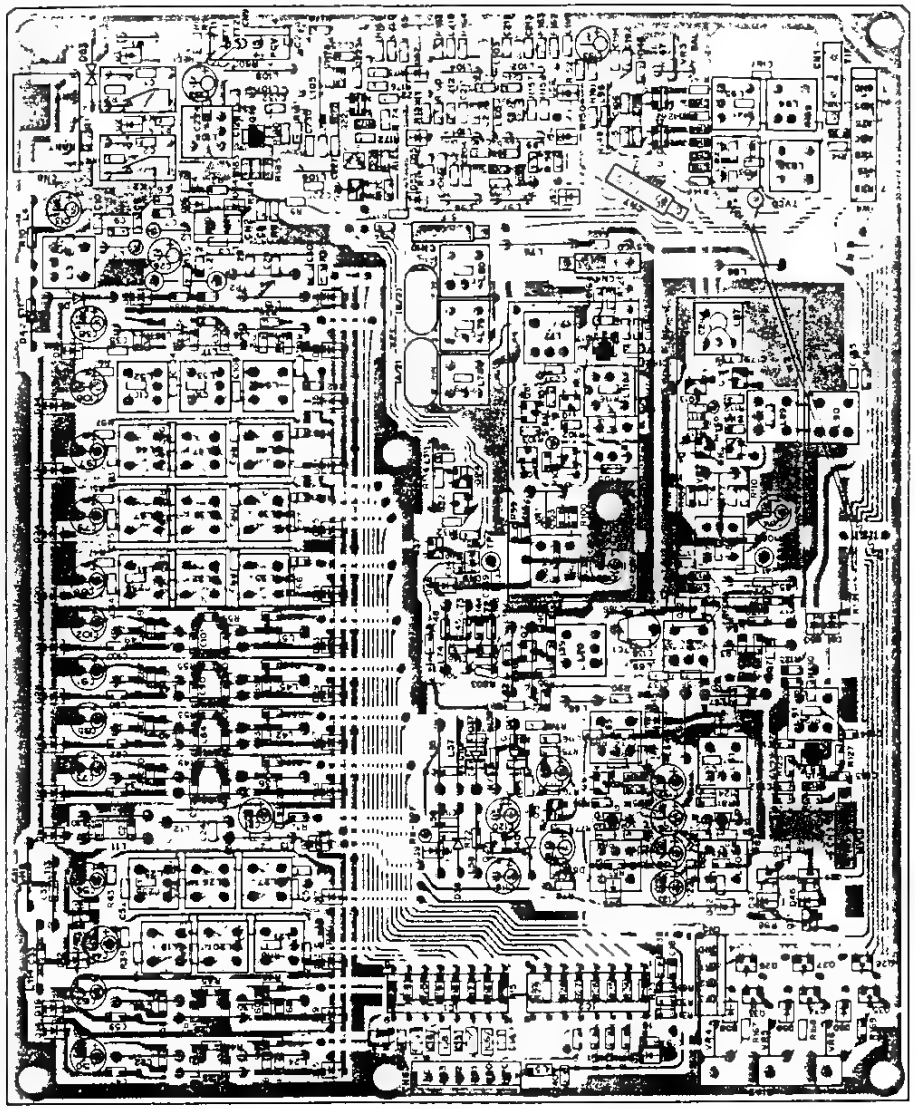


AVR UNIT (X43-3070-01) Foil side view

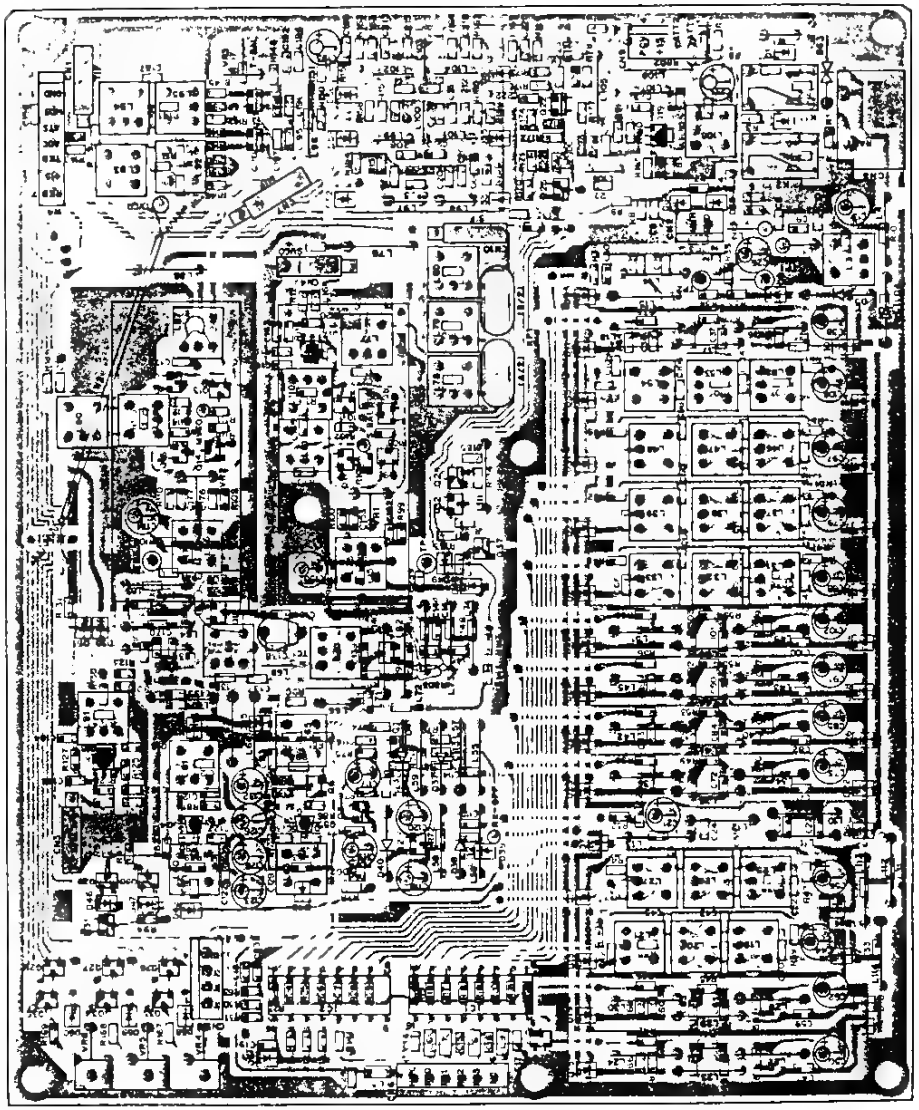


TS-950S/SD PC BOARD VIEWS

RF UNIT (X44-3100-00) Component side view



RF UNIT (X44-3100-00) Foil side view



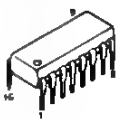
2SA1162
2SA2712
DTA114EK
DTA124EK
DTC114EK
DTC124EK
2SC2954

2SC2954

2SK125-5

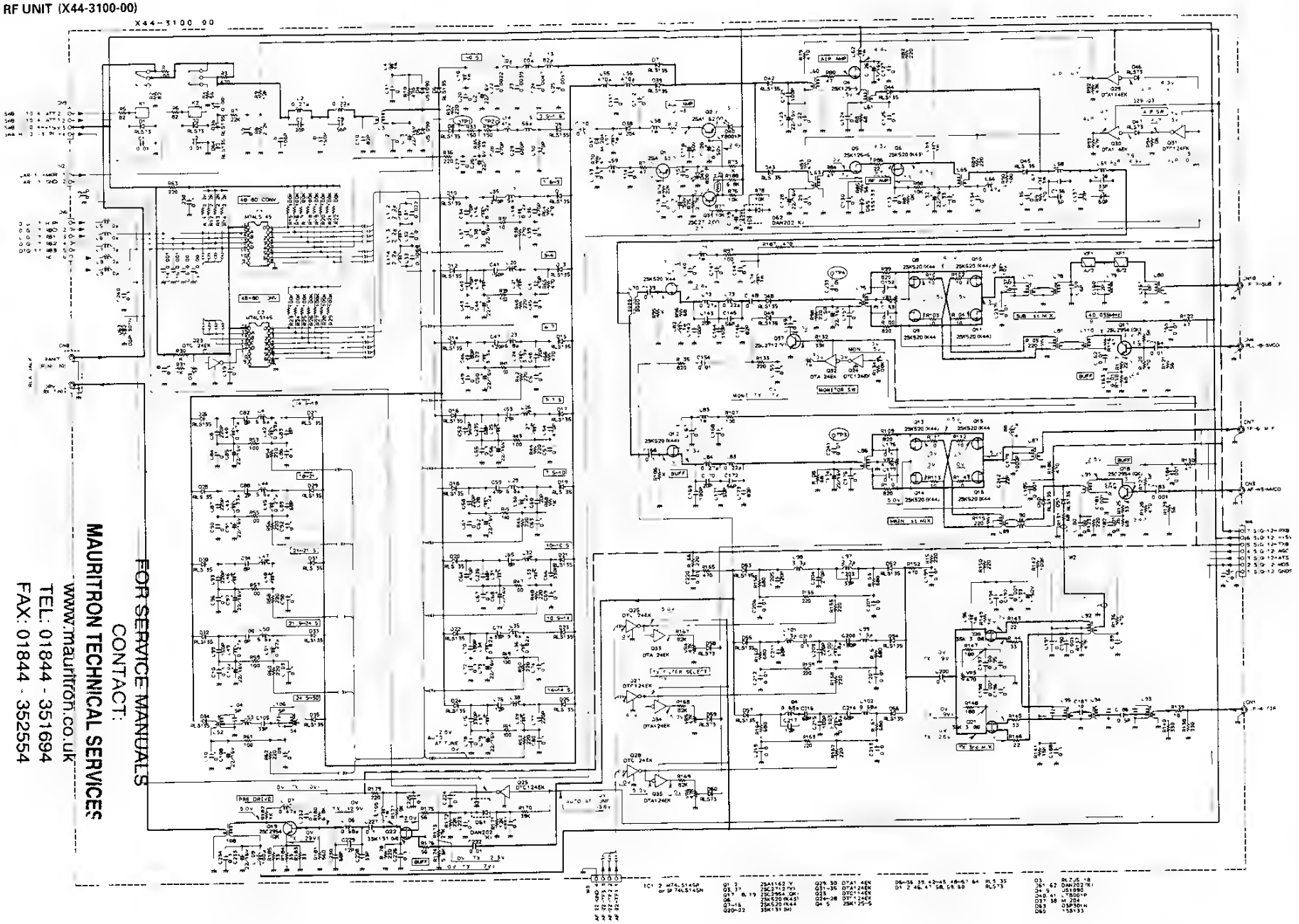
3SK131

SN74LS145N



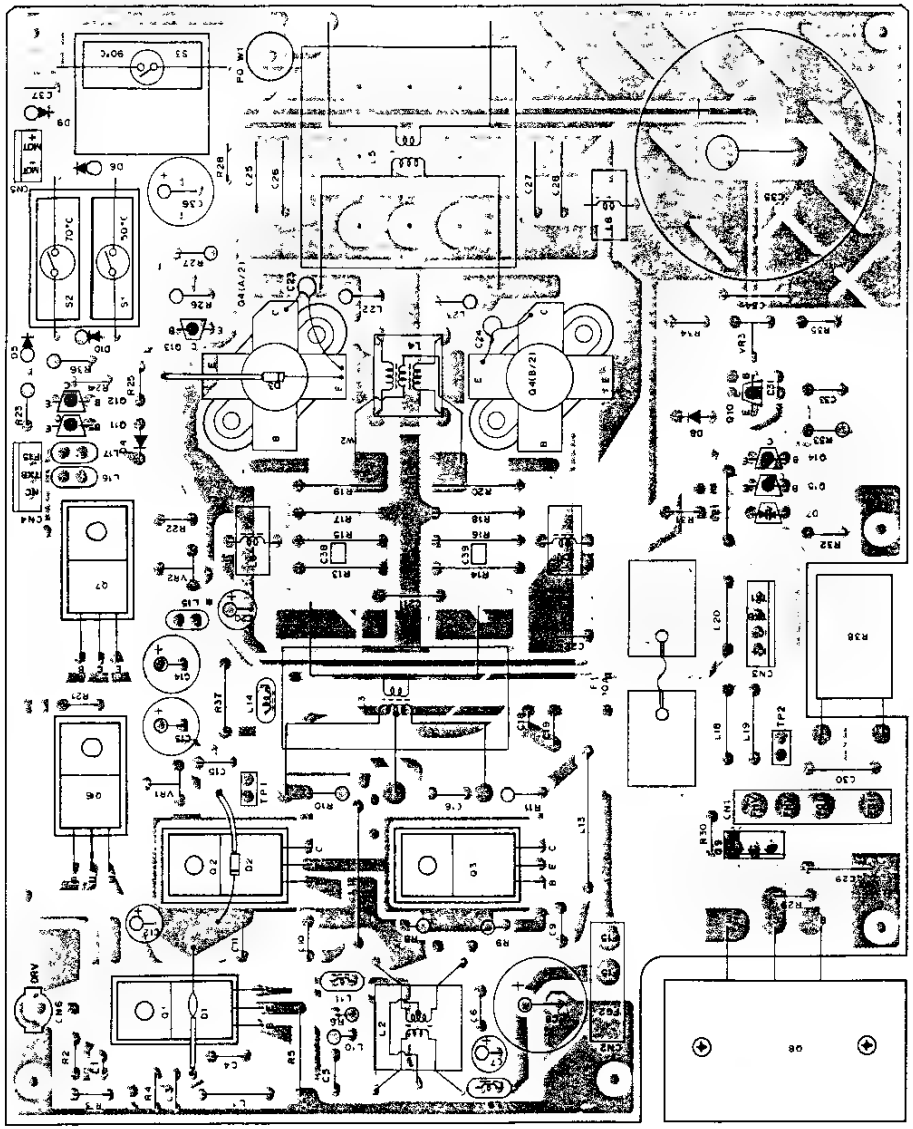
2SK520

RF UNIT (X44-3100-00)

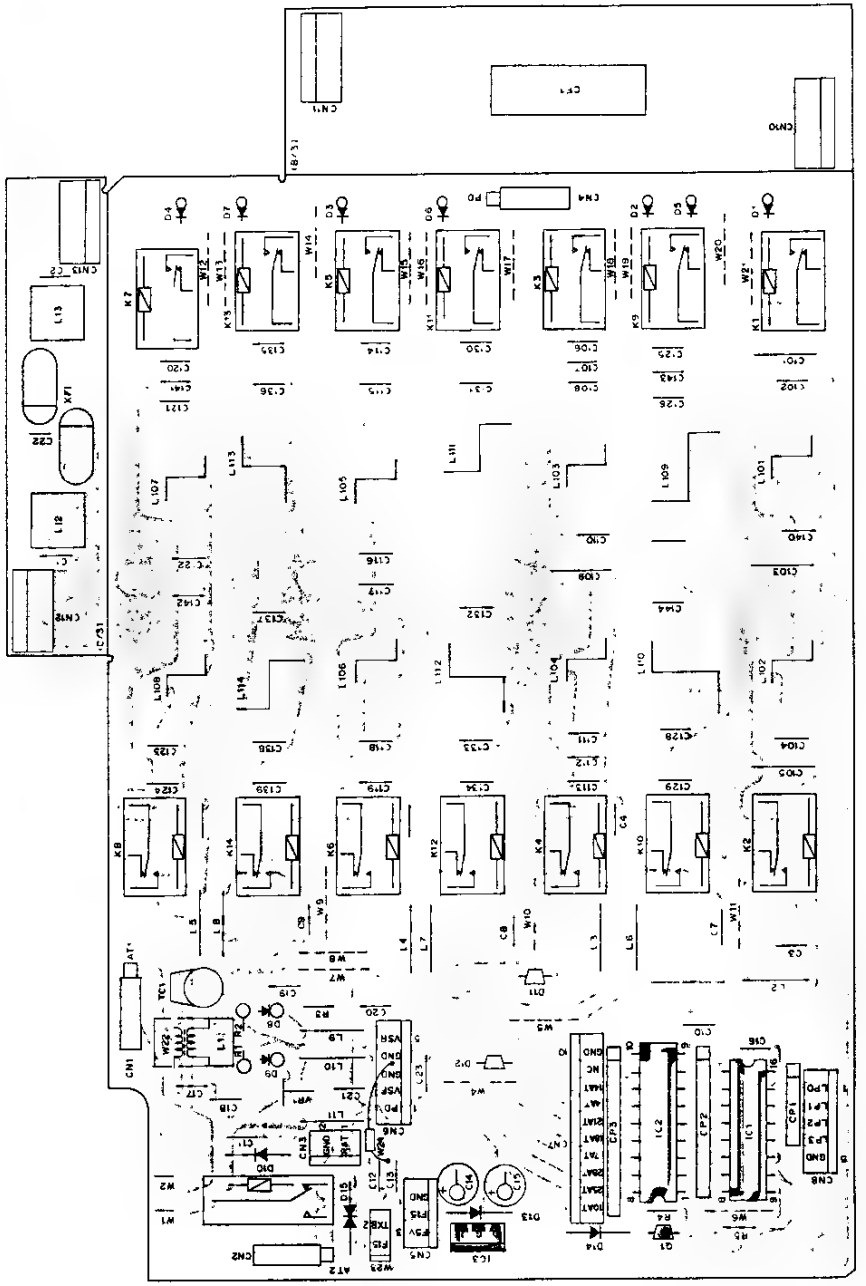


TS-950S/SD PC BOARD VIEWS

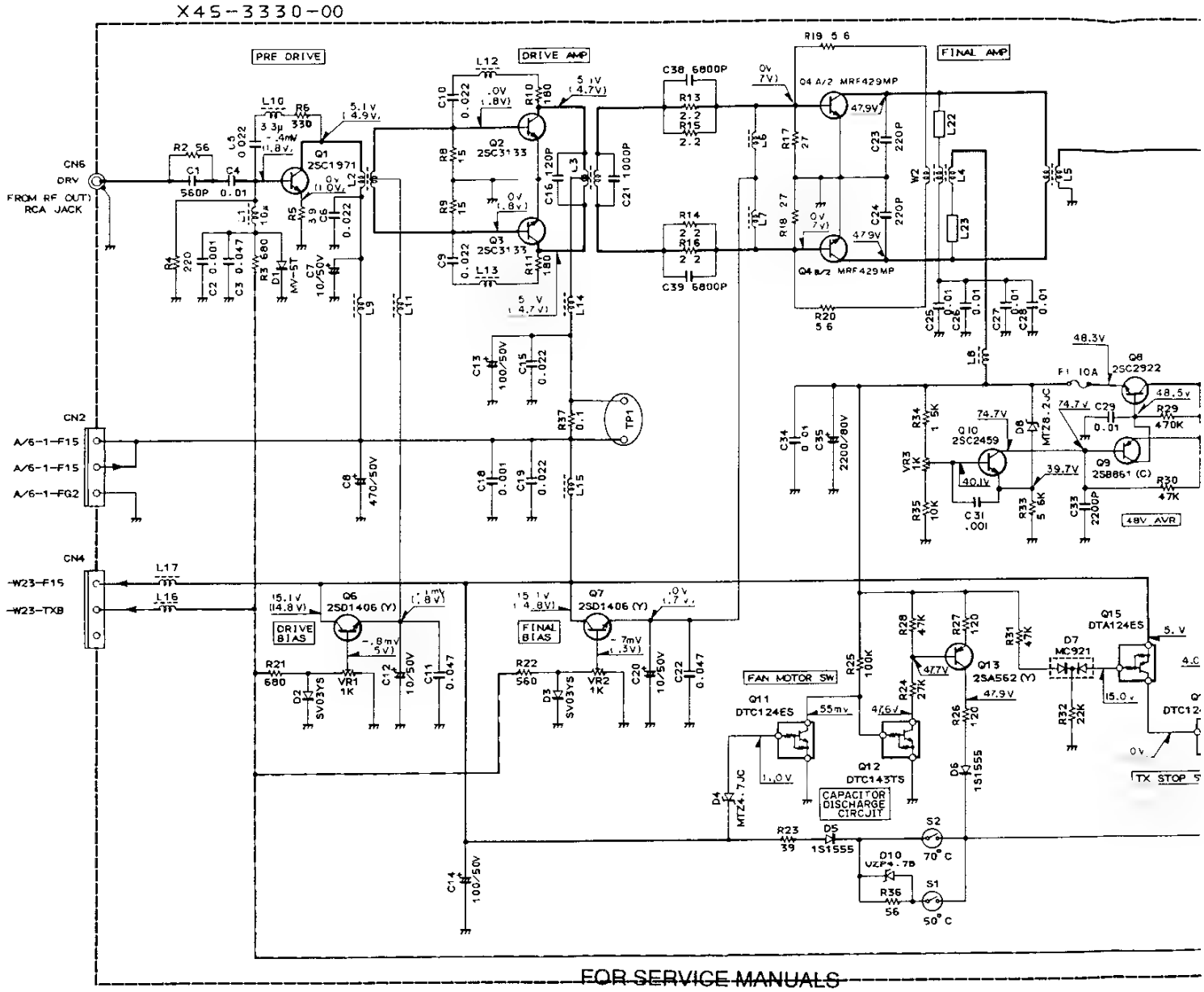
FINAL UNIT (X45-3330-00) Component side view



FILTER UNIT (X51-3060-XX) Component side view



VAL UNIT (X45-3330-00)



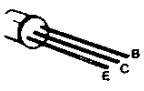
Q1 : 2SC1971
Q2, 3 : 2SC3133
Q6, 7 2SD1406 (Y)
Q8 : 2SC2922
Q9 : 2SB861 (C)
Q10 : 2SC2459 (BL)

Q4 : MRF429MP

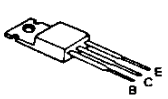
Q11, 14 DTC124ES
Q12 : DTC143TS
Q13 : 2SA562 Y)
Q15 : DTA124ES

D1 : KB-365
D2, 3 : SV03YS
D4 : MTZ4.7JC
D5, 6, 9 1S1555
D7 : MC921
D8 : MTZ8.2JC
D10 : UZP4.7B

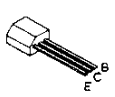
2SA562



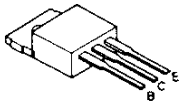
2SB861
2SC1971



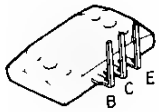
DTC124ES



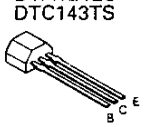
2SD1406



2SC2922

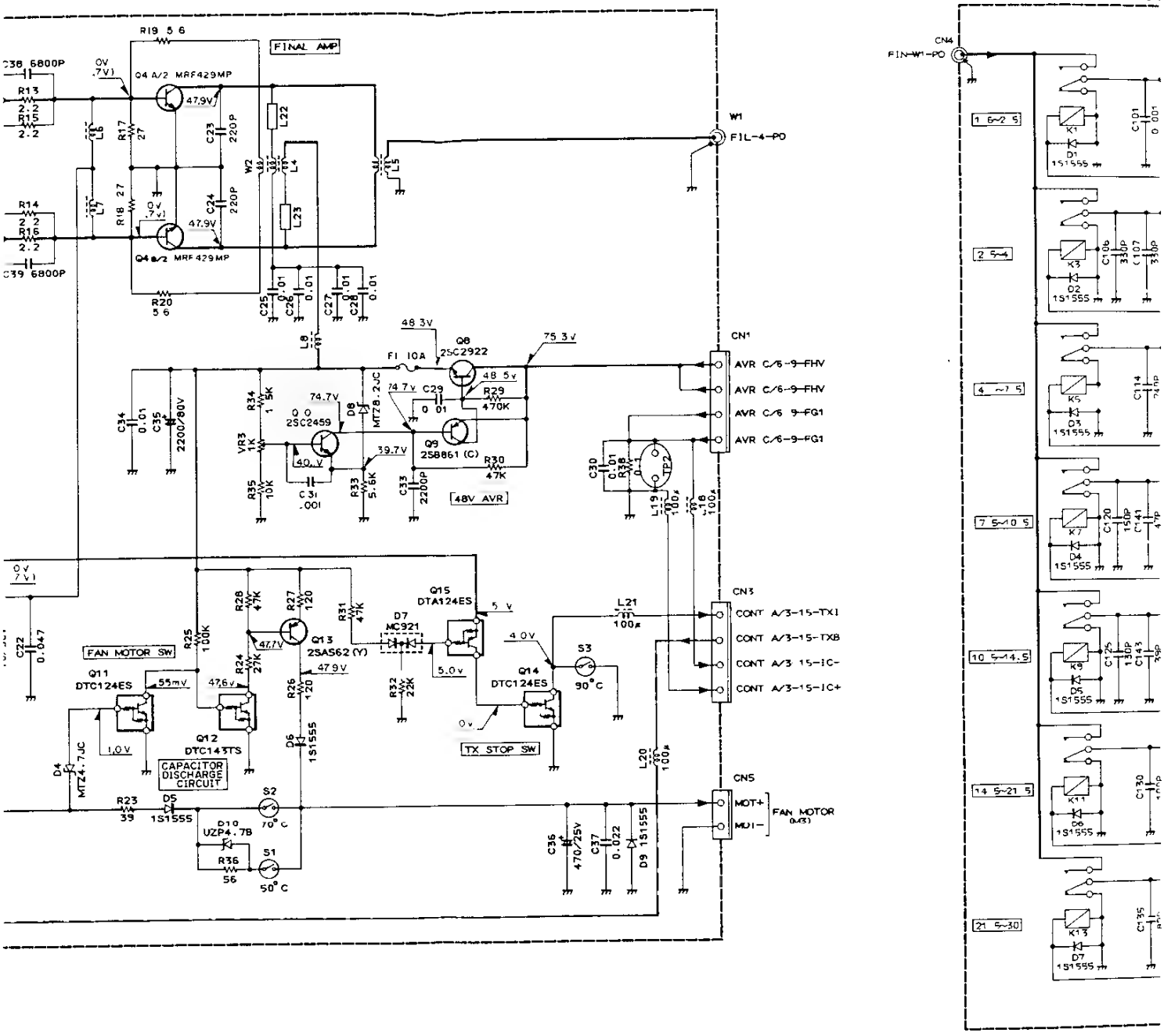


2SC2459
DTA124ES
DTC143TS

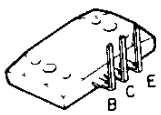


2SC31

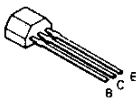
FILTER UNIT (X51-3060-XX) -



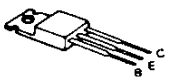
2SC2922



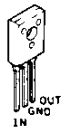
2SC2459
DTA124ES
DTC143TS



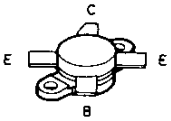
2SC3133



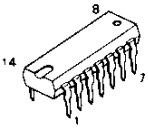
AN7805



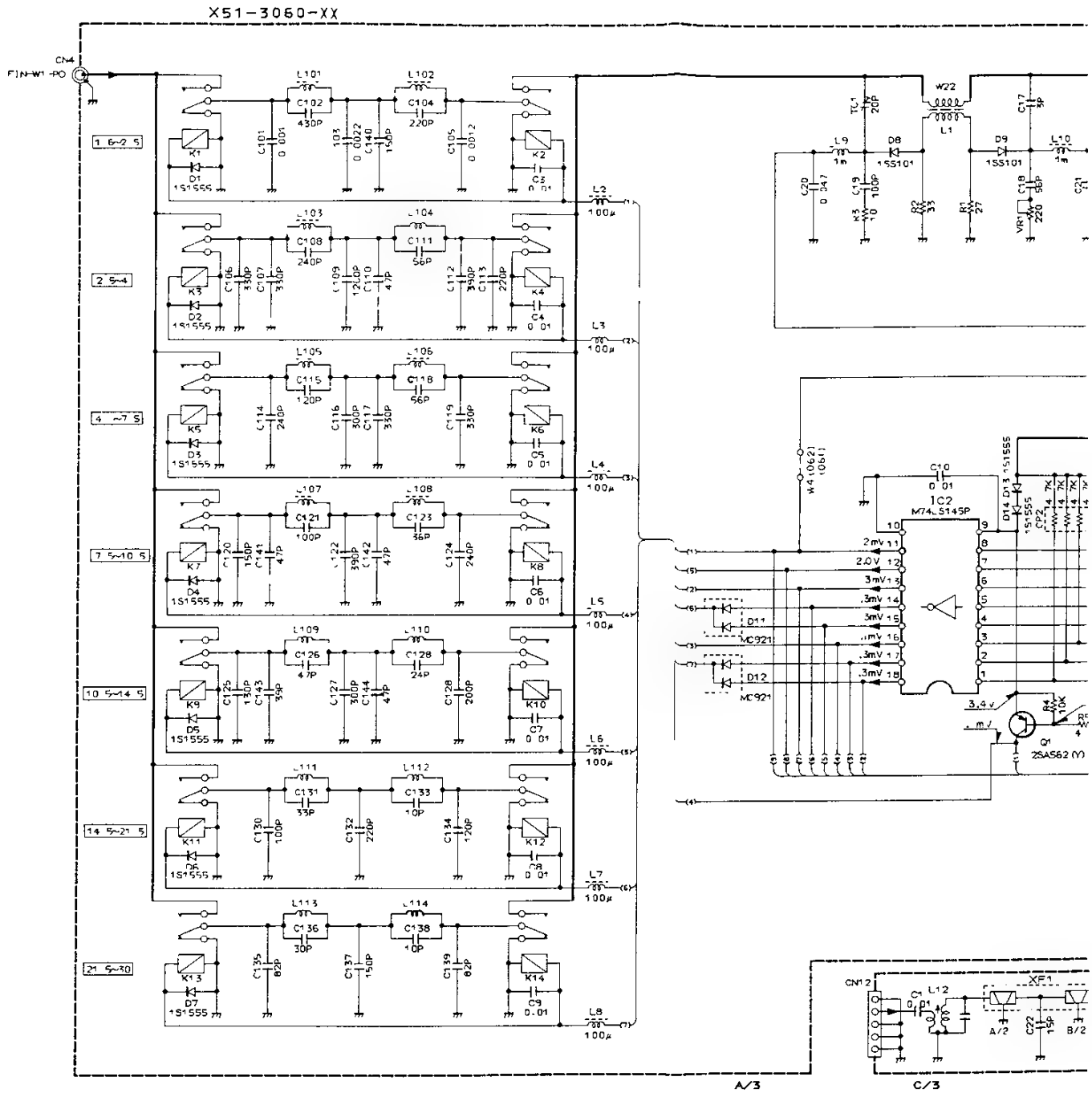
MRF427
MRF429MP



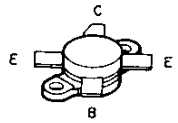
M54581P



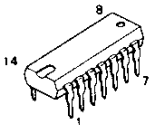
FILTER UNIT (X51-3060-XX) -01 : TS-950S (K,M,W,X,P) -61 : TS-950S (W2) -11 : TS-950SD (K,M,W,X,P) -62 : TS



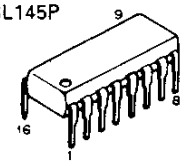
MRF427
MRF429MP



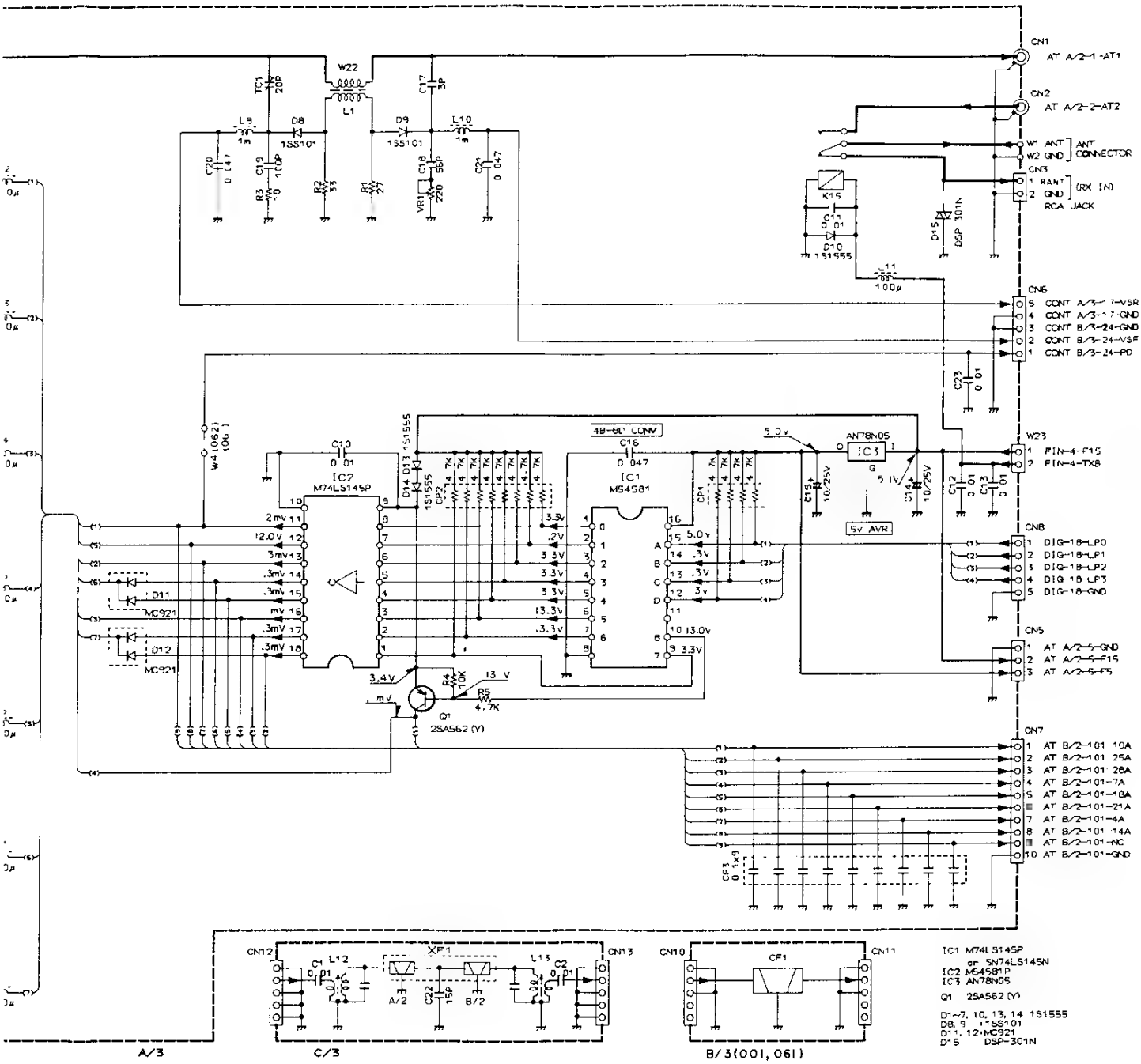
M54581P



M74LS145N
M74SL145P

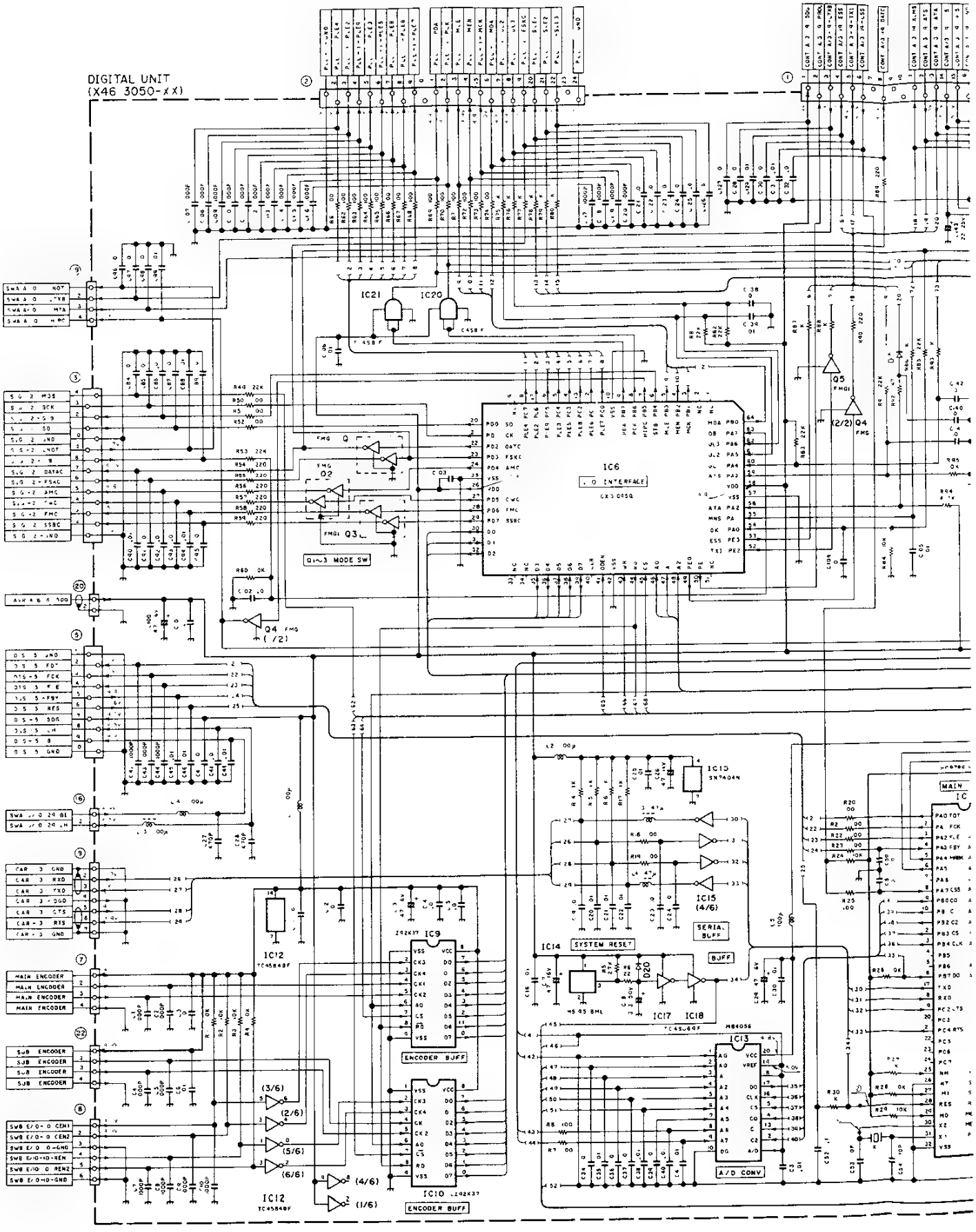


TS-950S (W2) -11 : TS-950SD (K,M,W,X,P) -62 : TS-950SD (W2)

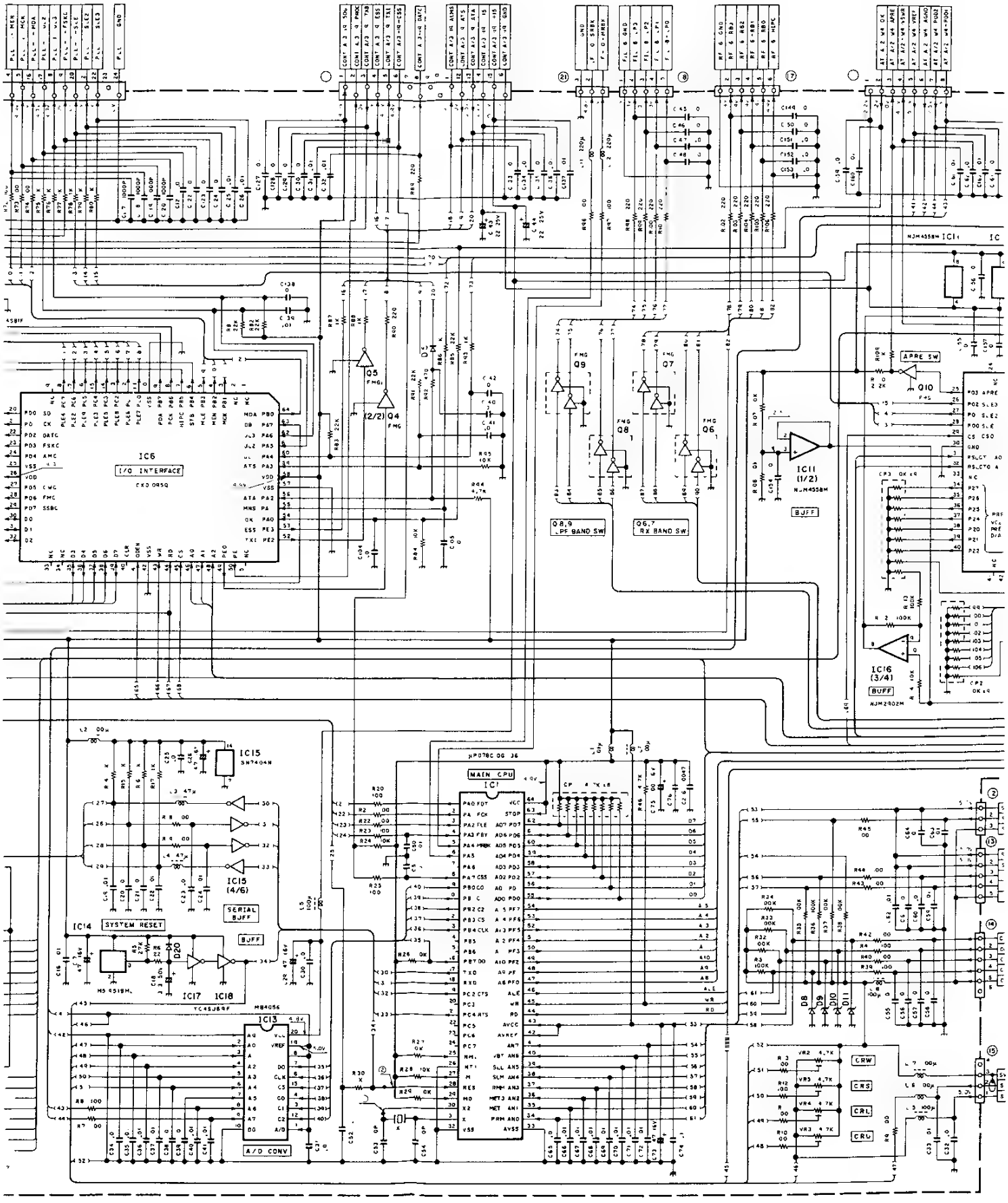


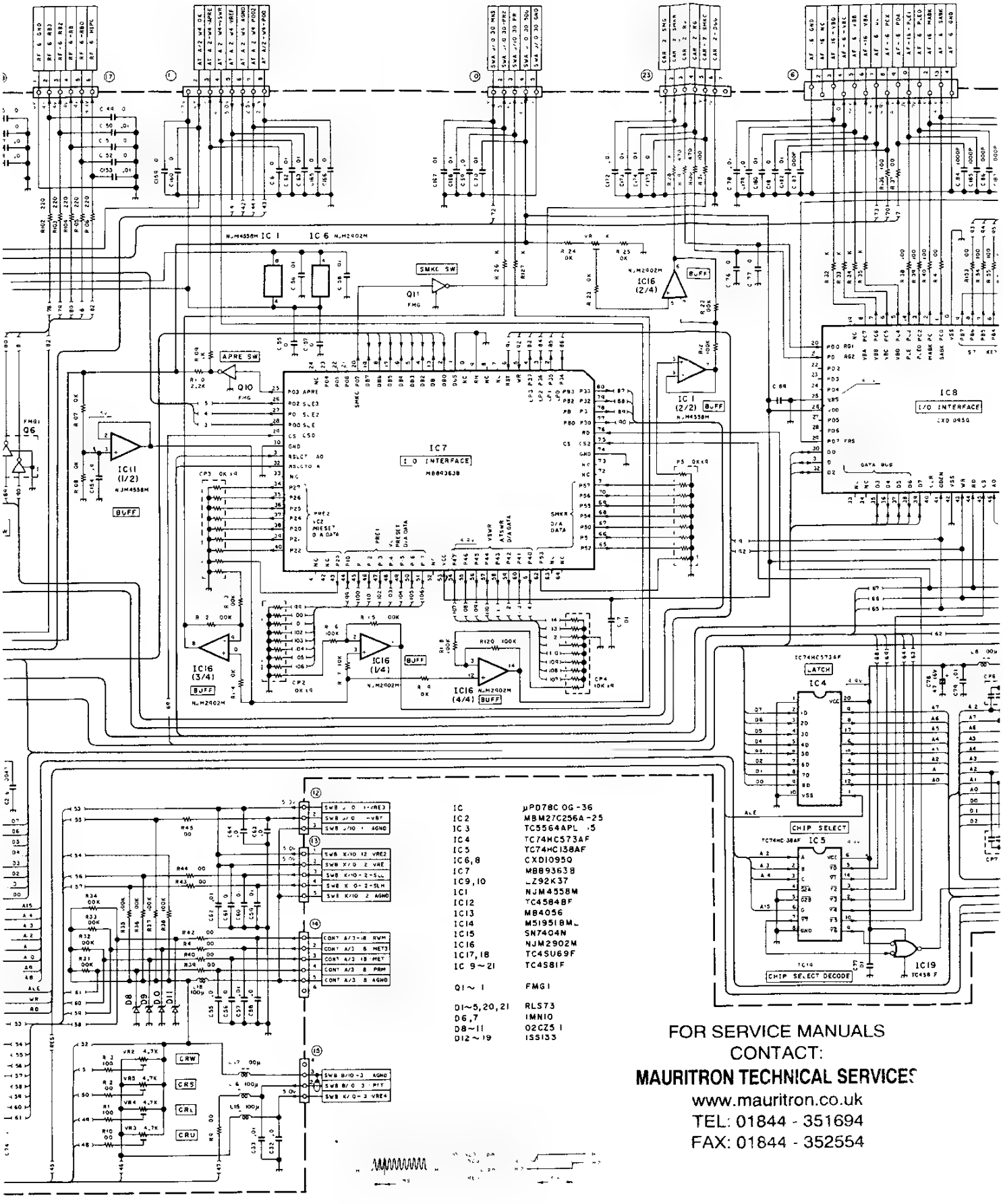
TS-950S/SD CIRCUIT DIAGRAM

DIGITAL UNIT (X46-3050-XX) -11 : K,P -21 : M -61 : W -62 : W2 -71 : X

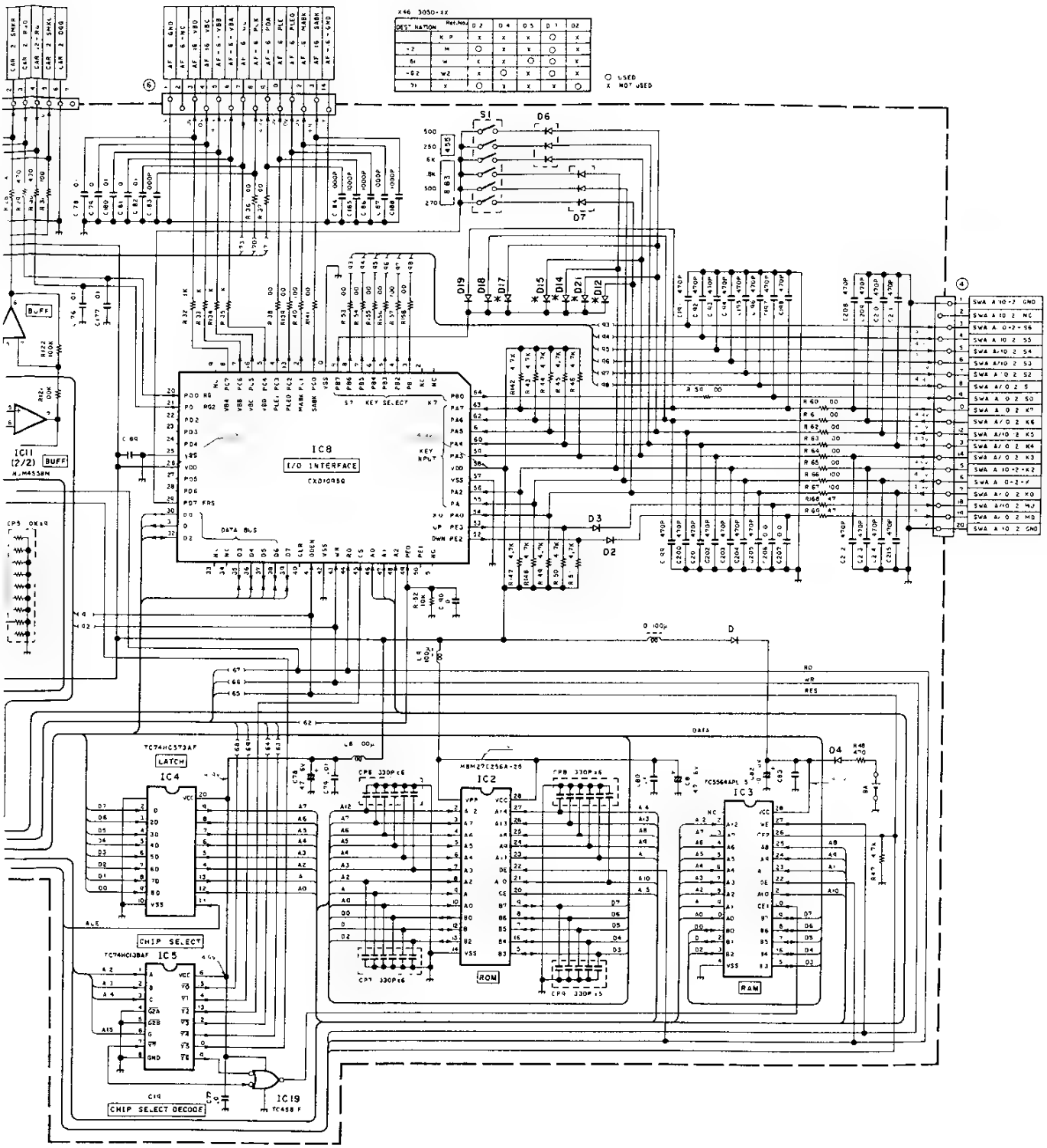


/ -62 : W2 -71 : X


IC6
I/O INTERFACE
IC1
MAIN CPU
IC11 (1/2)
NJM4558M
IC6 (3/4)
NJM2902M
IC15
SN7404N
IC15 (4/6)
SERIAL BUFF
IC14
SYSTEM RESET
BUFF
IC17
IC18
IC13
A/D CONV
APRE SW
Q8,9 LPF BAND SW
Q6,7 RX BAND SW
CRW
CRS
CRL
CRU



IC	μPD78C OG-36
IC2	MBM27C256A-25
IC 3	TC5564APL -5
IC4	TC74HC573AF
IC5	TC74HC138AF
IC6,8	CXD1095Q
IC7	MB893638
IC9,10	uZ92K37
IC1	NJM4558M
IC12	TC4584BF
IC13	MB4056
IC14	M51951BM-
IC15	SN7404N
IC16	NJM2902M
IC17,18	TC4SU69F
IC 9~21	TC4581F
Q1~ 1	FMG1
D1~5,20,21	RLS73
D6,7	1MN10
D8~11	02CZ5 1
D12~19	1SS133



FOR SERVICE MANUALS
CONTACT:

MAURITRON TECHNICAL SERVICES

www.mauritron.co.uk
TEL: 01844 - 351694
FAX: 01844 - 352554

M51951BML

FMG1

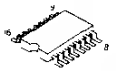
TC4S81F
TC4SU69F

NJM4558M

SN7404N

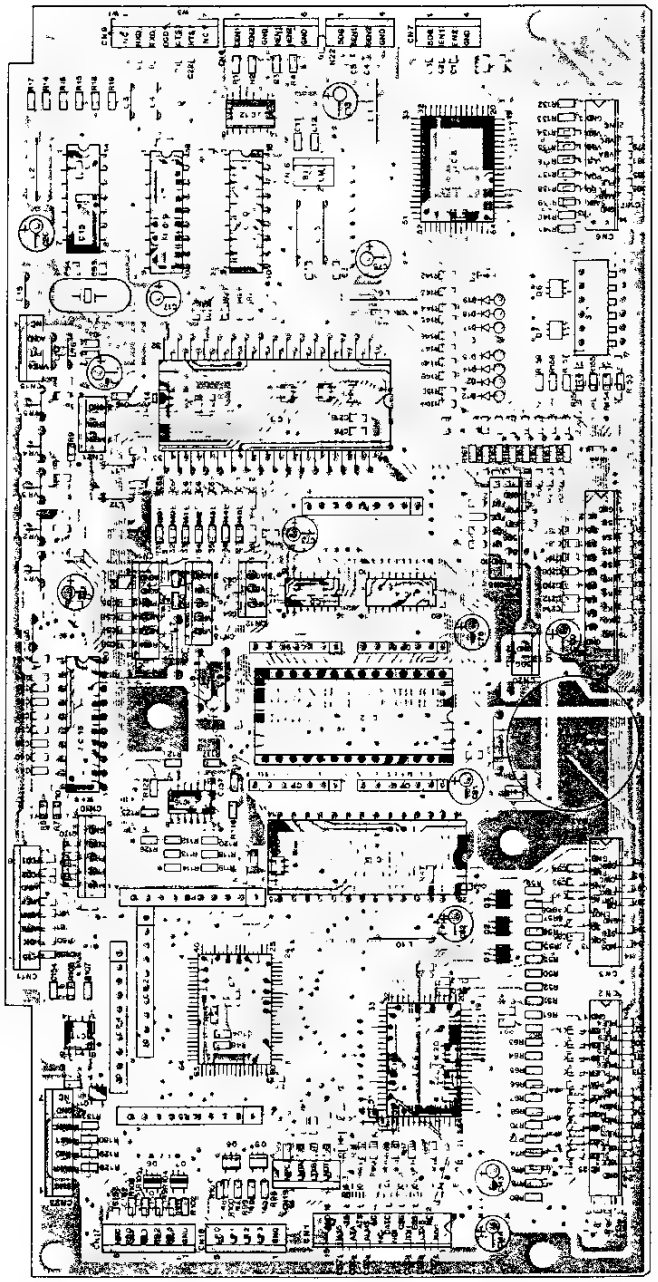
NJM2902M

TC74HC138AF
TC4584BF

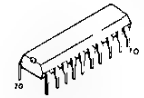


LZ92K37

DIGITAL UNIT (X46-3050-XX) Component side view



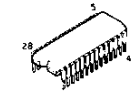
TC74HC573AF



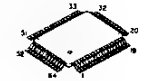
M84056

27C256A-25JAW3

TC5564APL-15

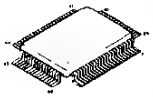


CXD1095Q

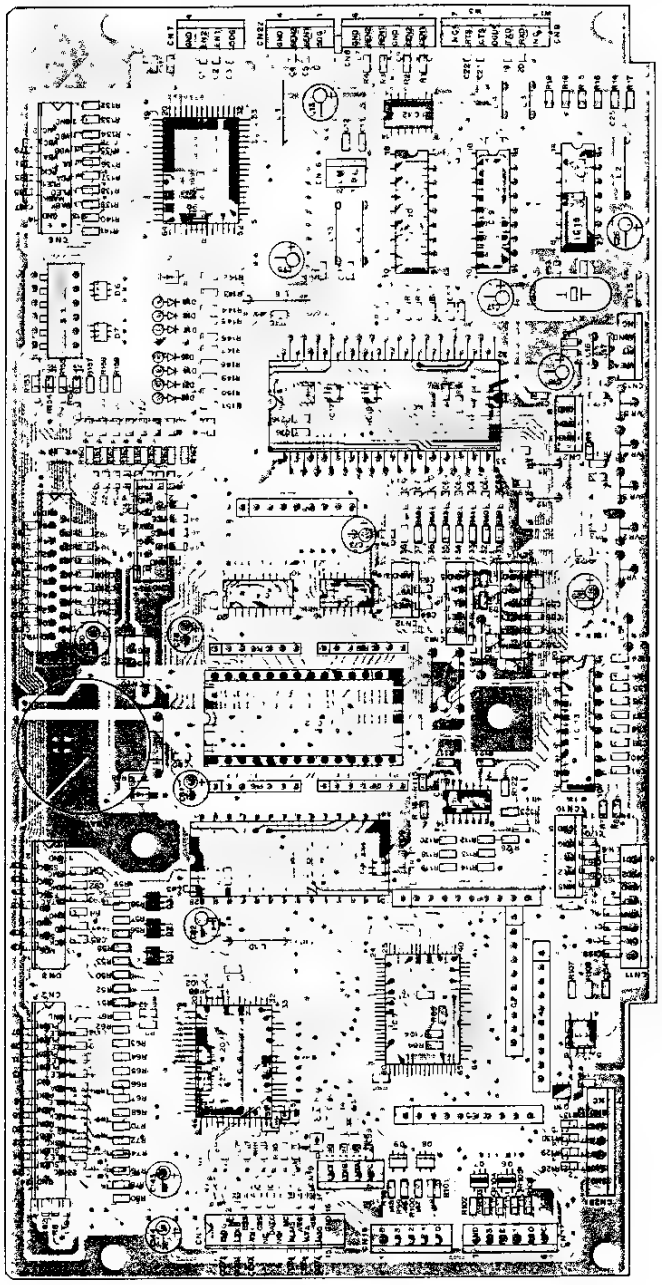


μPD78C10G-36

MB89363B

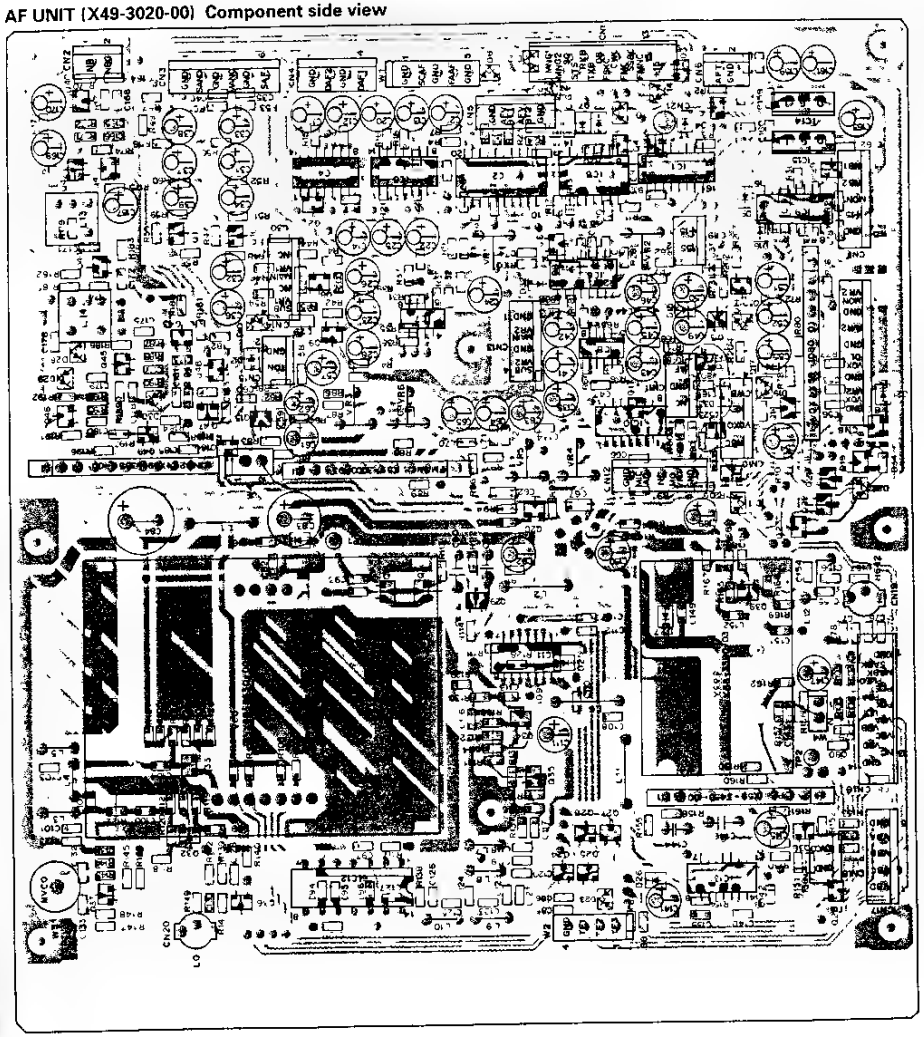


DIGITAL UNIT (X46-3050-XX) Foil side view

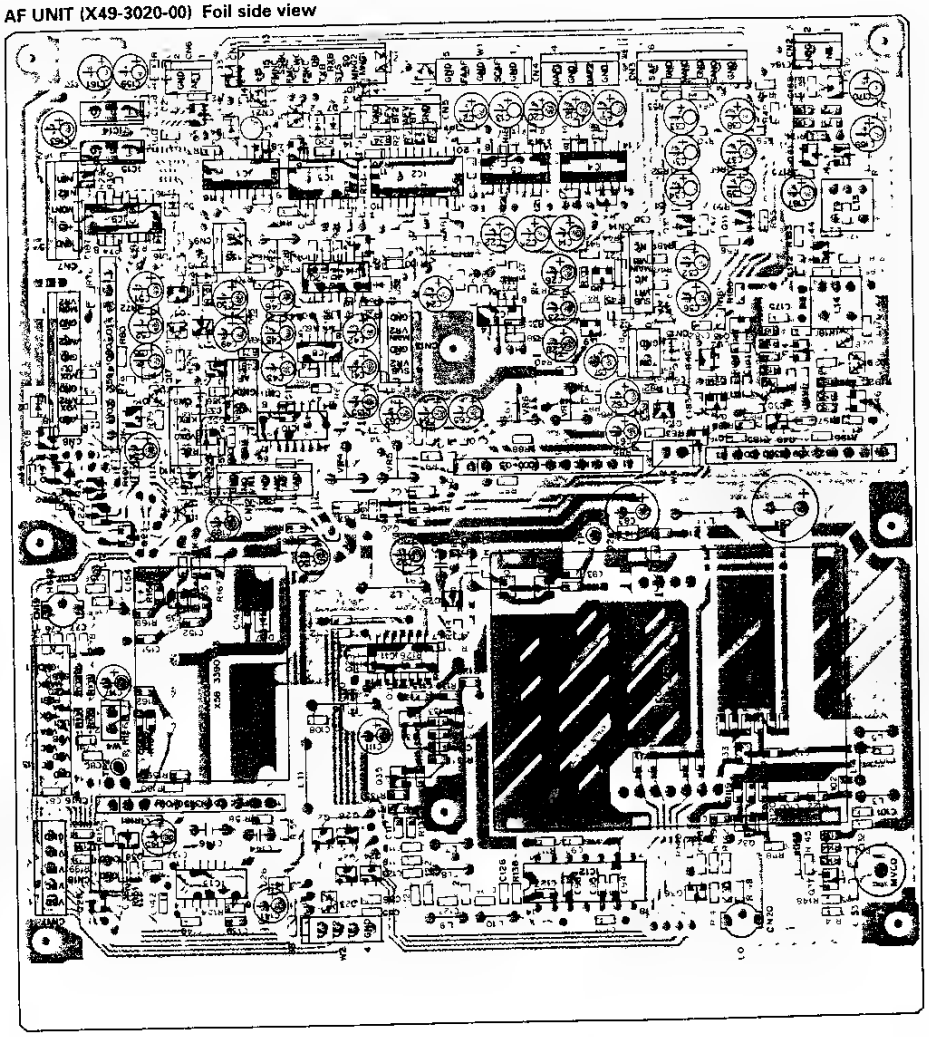


TS-950S/SD PC BOARD VIEWS

AF UNIT (X49-3020-00) Component side view



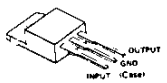
AF UNIT (X49-3020-00) Foil side view



2SA1162
2SC2712
2SC2714
2SC3324
2SD1757
DTA124EK
DTC114EK
DTC114TK
DTC124EK
DTC114WK
2SC2996

2SK210

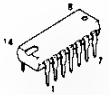
AN78N10



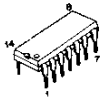
AN78N05

NJM4558M

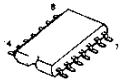
SN76514N



CXD1225M



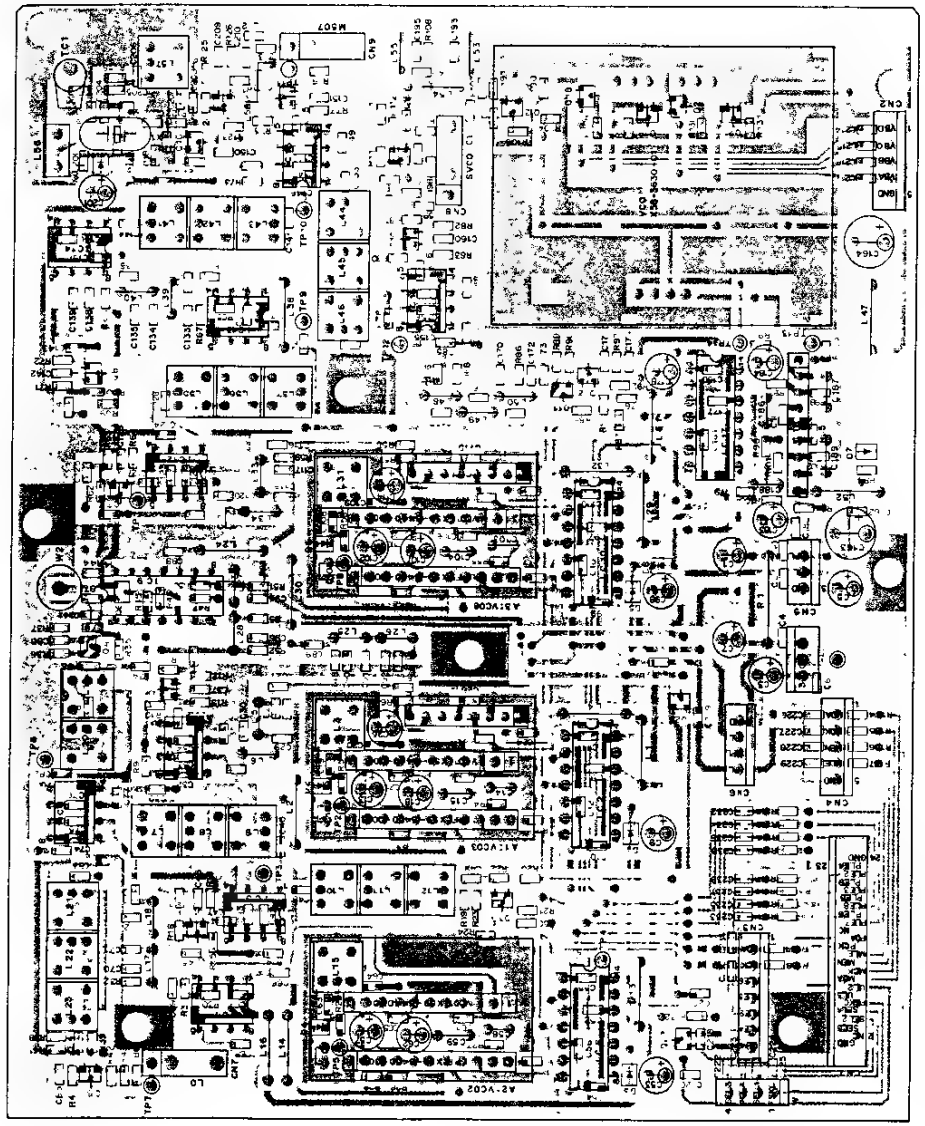
MF5CCWM
TC4066BF



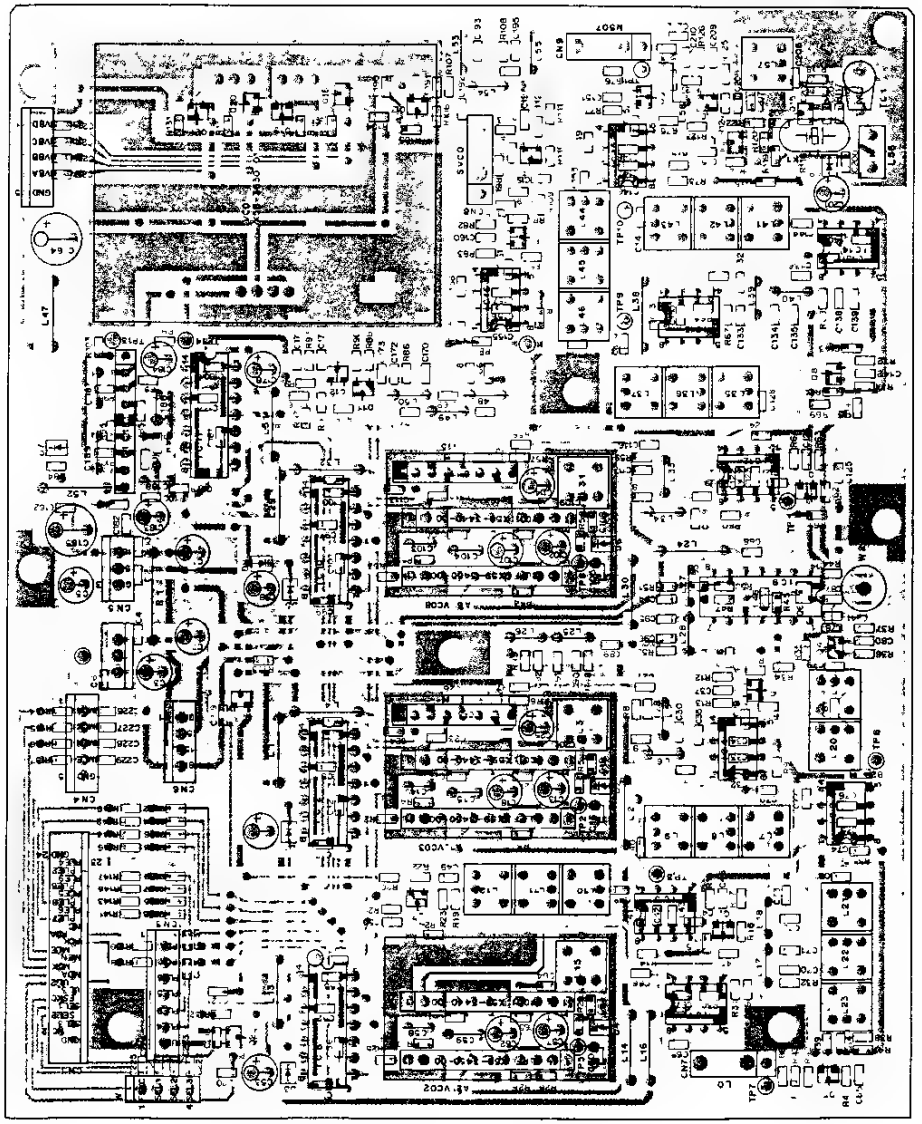
SN74LS390NS
TC4538BF

MF10CCWM

PLL UNIT (X50-3100-00) Component side view

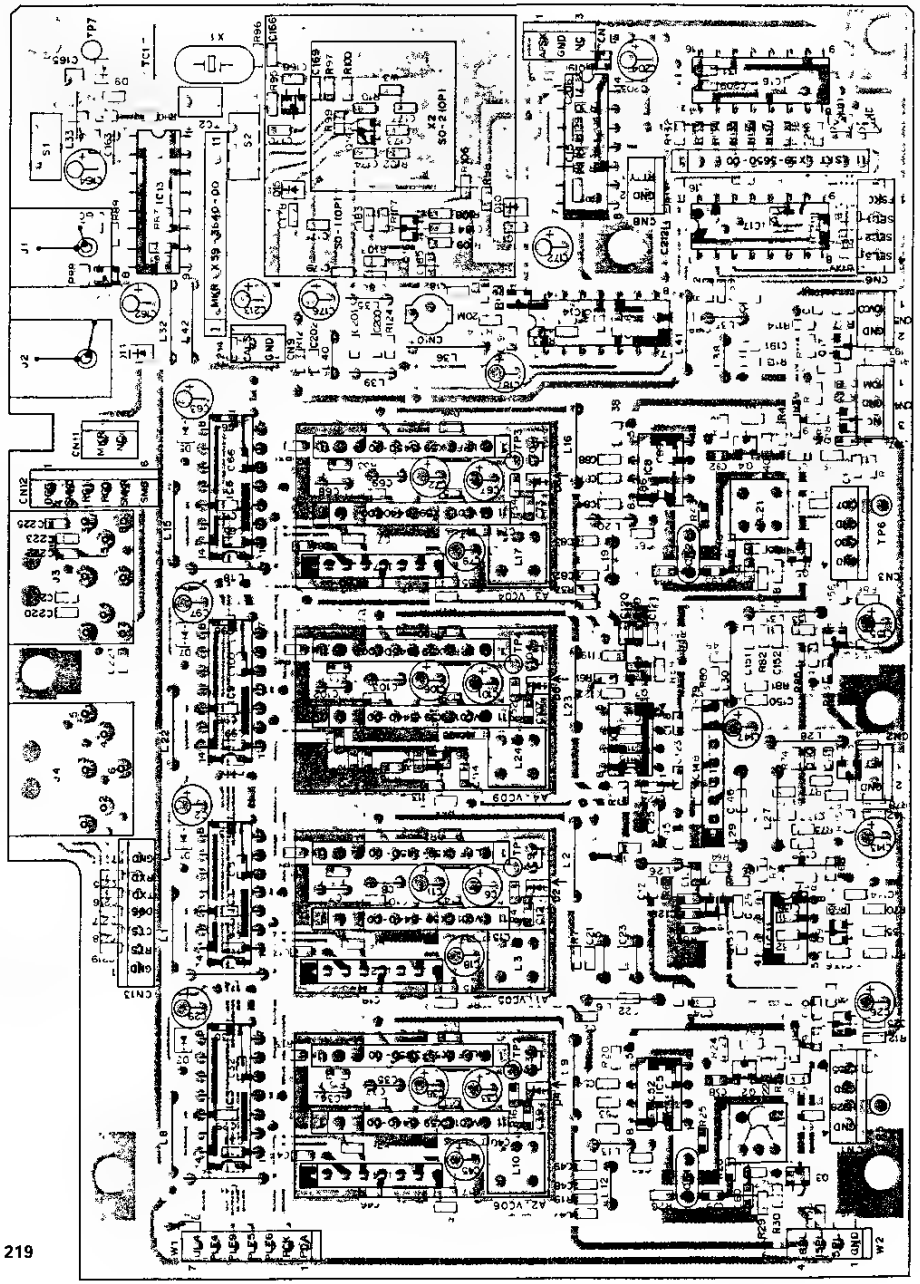


PLL UNIT (X50-3100-00) Foil side view

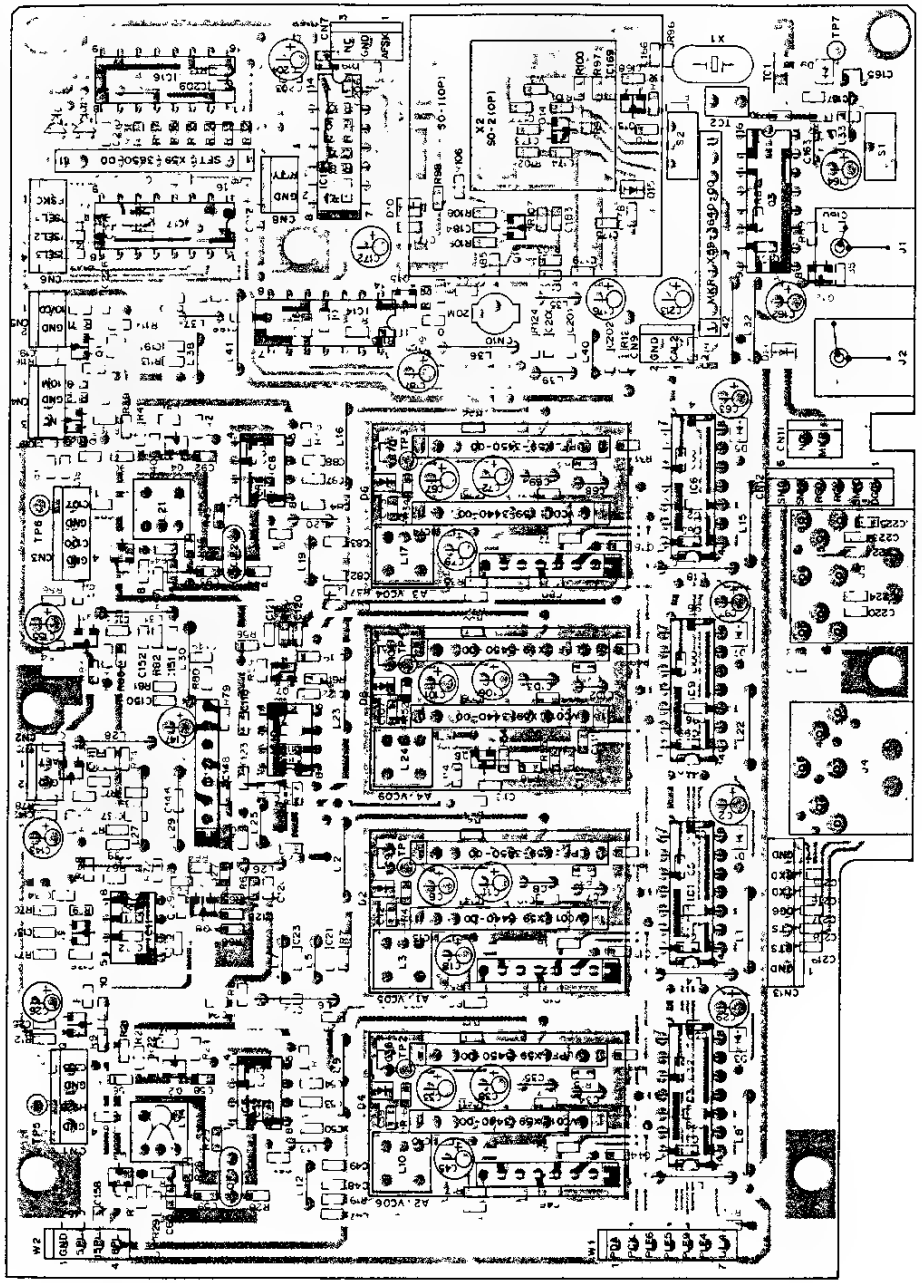


TS-950S/SD PC BOARD VIEWS

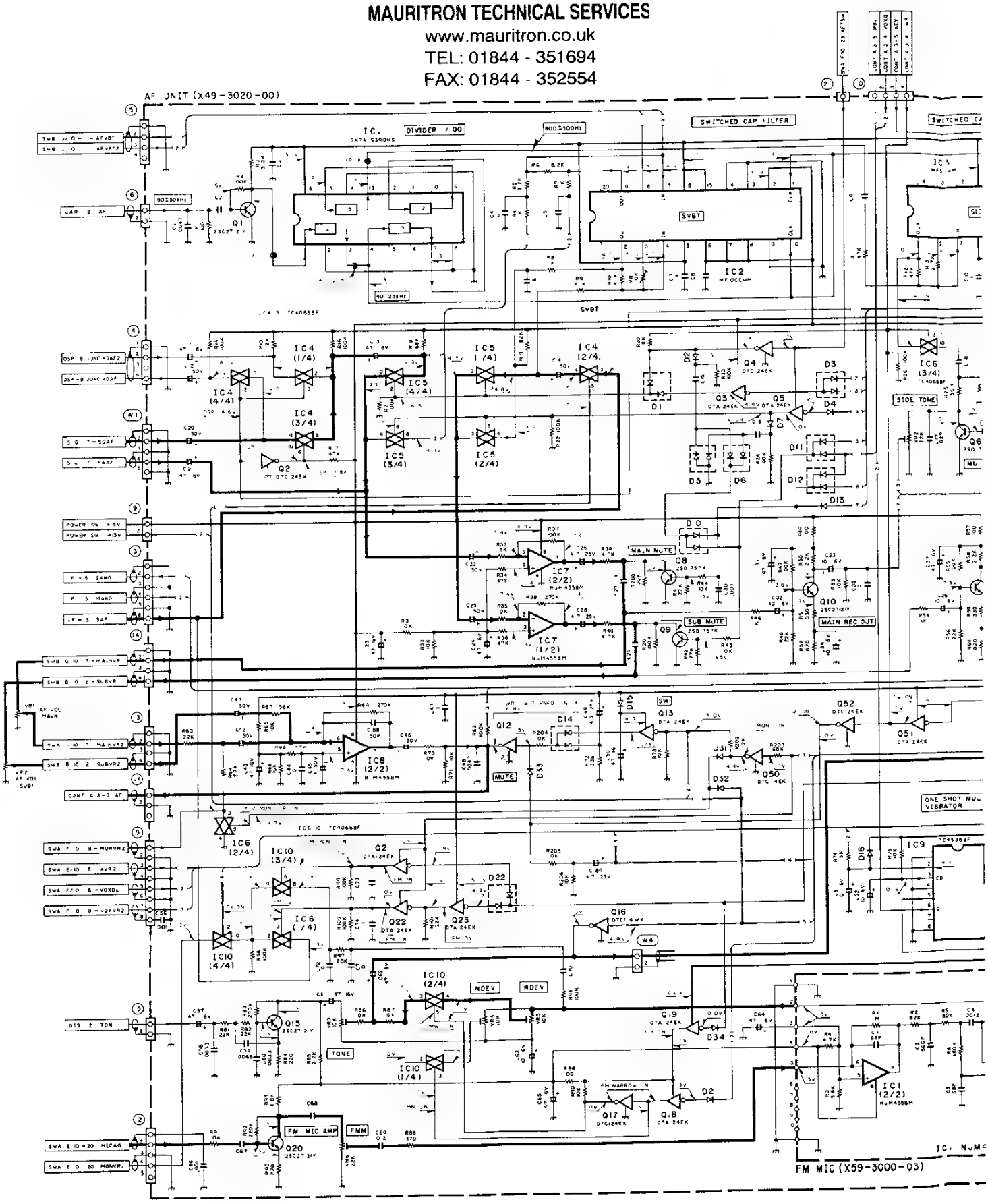
CAR UNIT (X50-3110-XX) Component side view

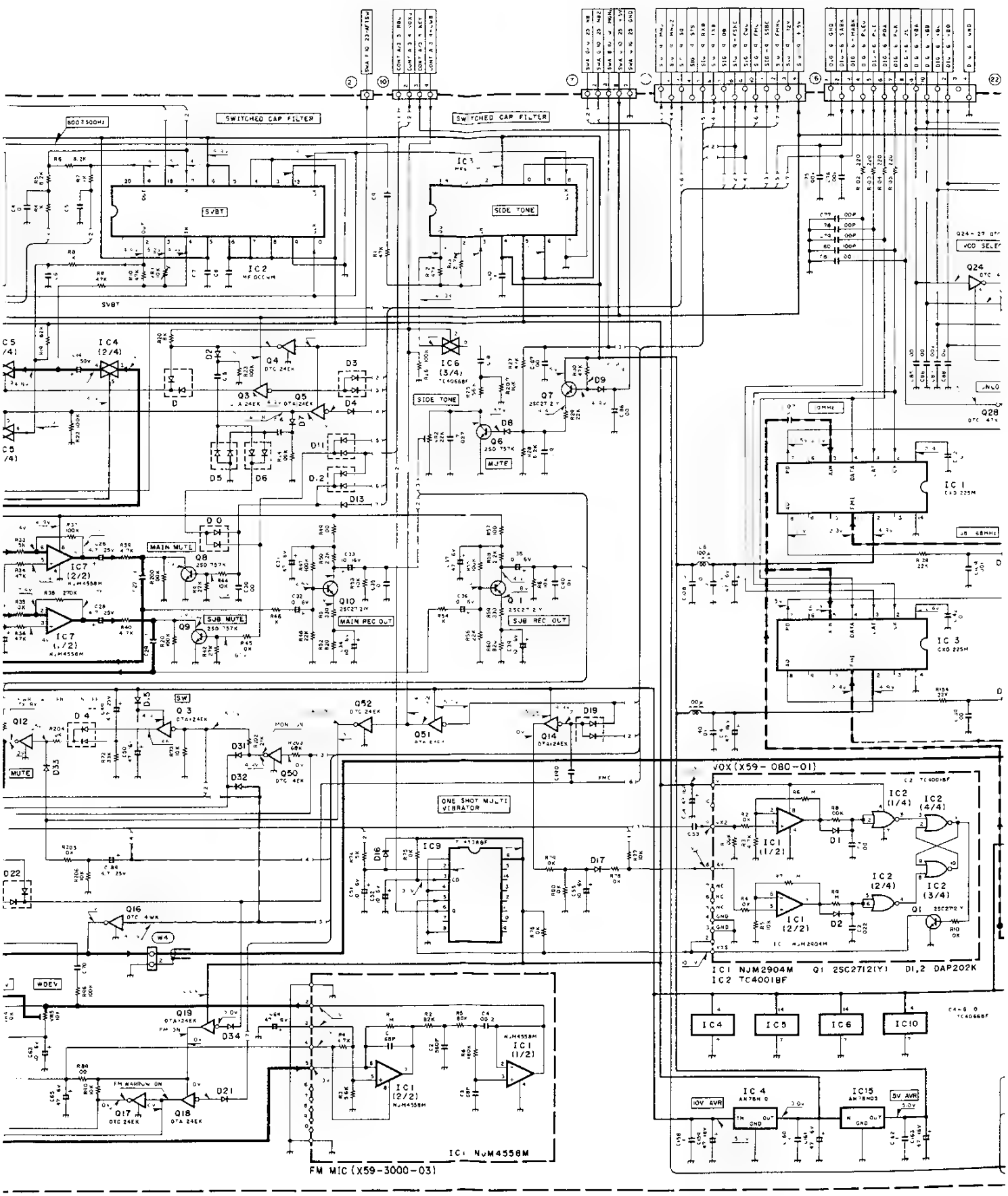


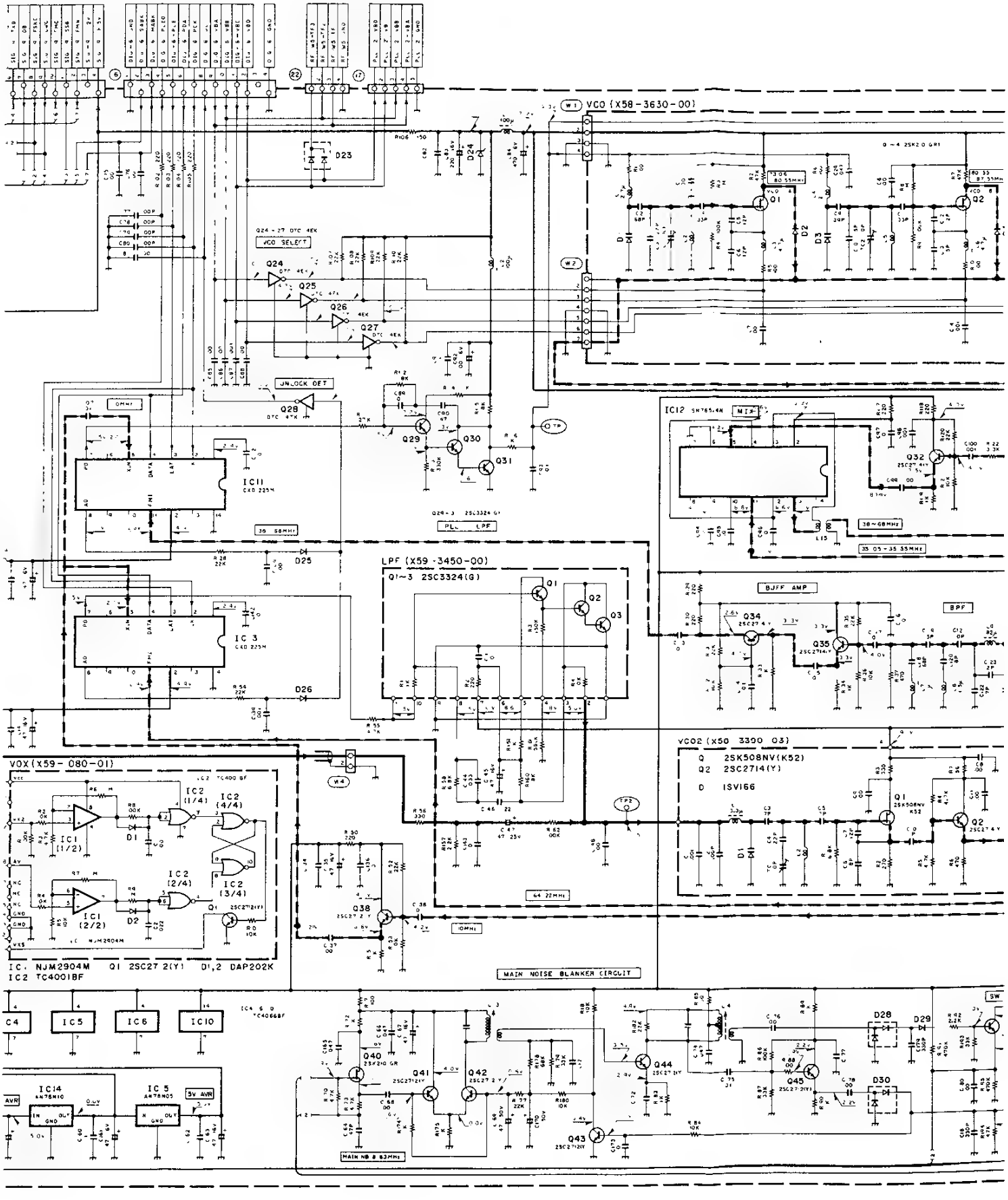
CAR UNIT (X50-3110-XX) Foil side view



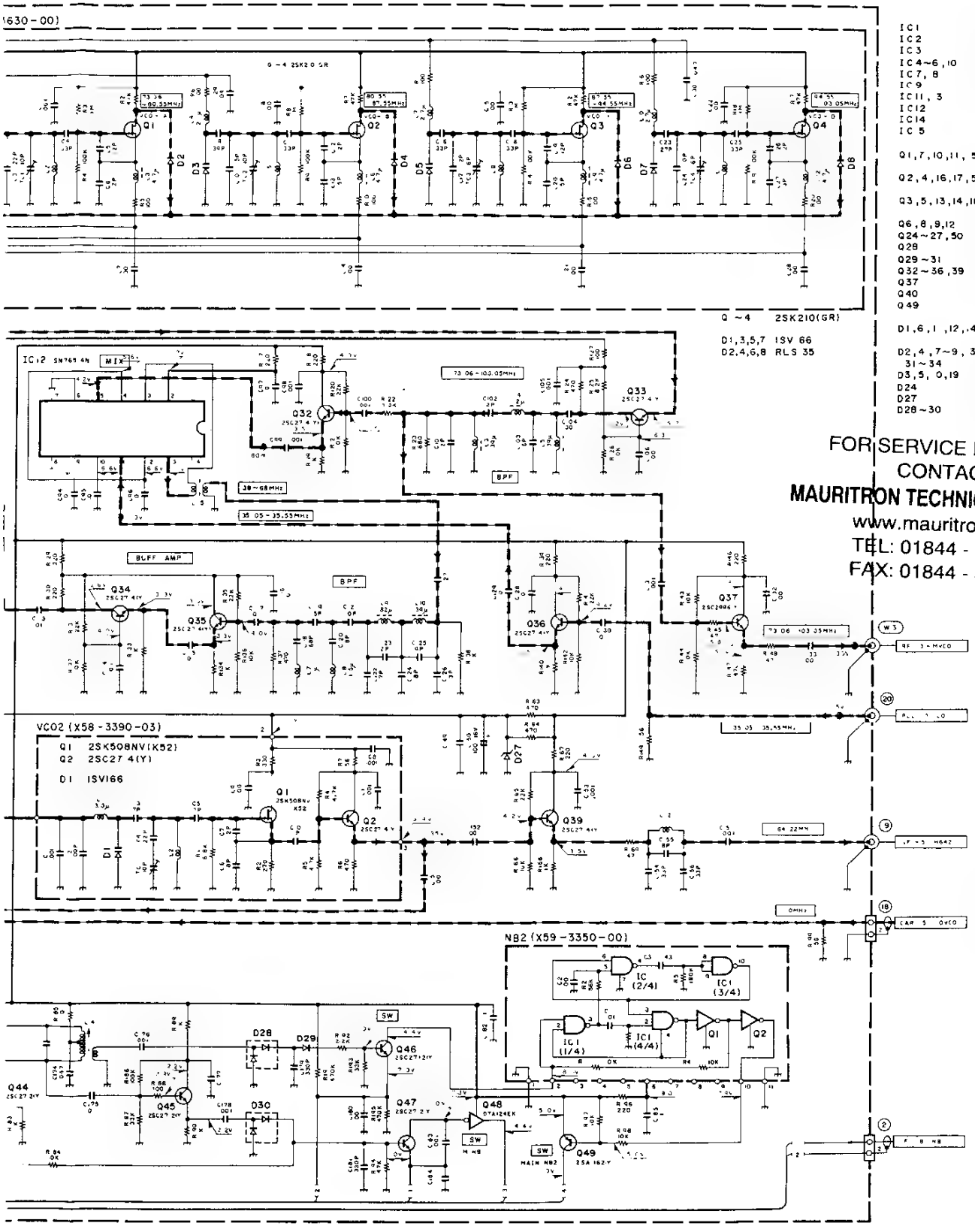
AF UNIT (X49-3020-00)




SWITCHED CAP FILTER
SW TCHED CAP FILTER
SVBT
SIDE TONE
MAIN MUTE
SUB MUTE
MUTE
MAIN REC OUT
SUB REC OUT
ONE SHOT MULTI VIBRATOR
VOX (X59-080-01)
IC1 NJM2904M Q1 2SC2712(Y) D1,2 DAP202K
IC2 TC4001BF
FM MIC (X59-3000-03)
IC: NJM4558M
10V AVR
5V AVR


VCO (X58-3630-00)
LPF (X59-3450-00)
Q1~3 2SC3324(G)
VOX (X59-080-01)
VCO2 (X50-3300-03)
Q1 2SK508NV(K52)
Q2 2SC2714(Y)
D ISV166
BUFF AMP
BPF
MAIN NOISE BLANKER CIRCUIT
IC. NJM2904M Q1 2SC27 2(Y) D1,2 DAP202K
IC2 TC4001BF

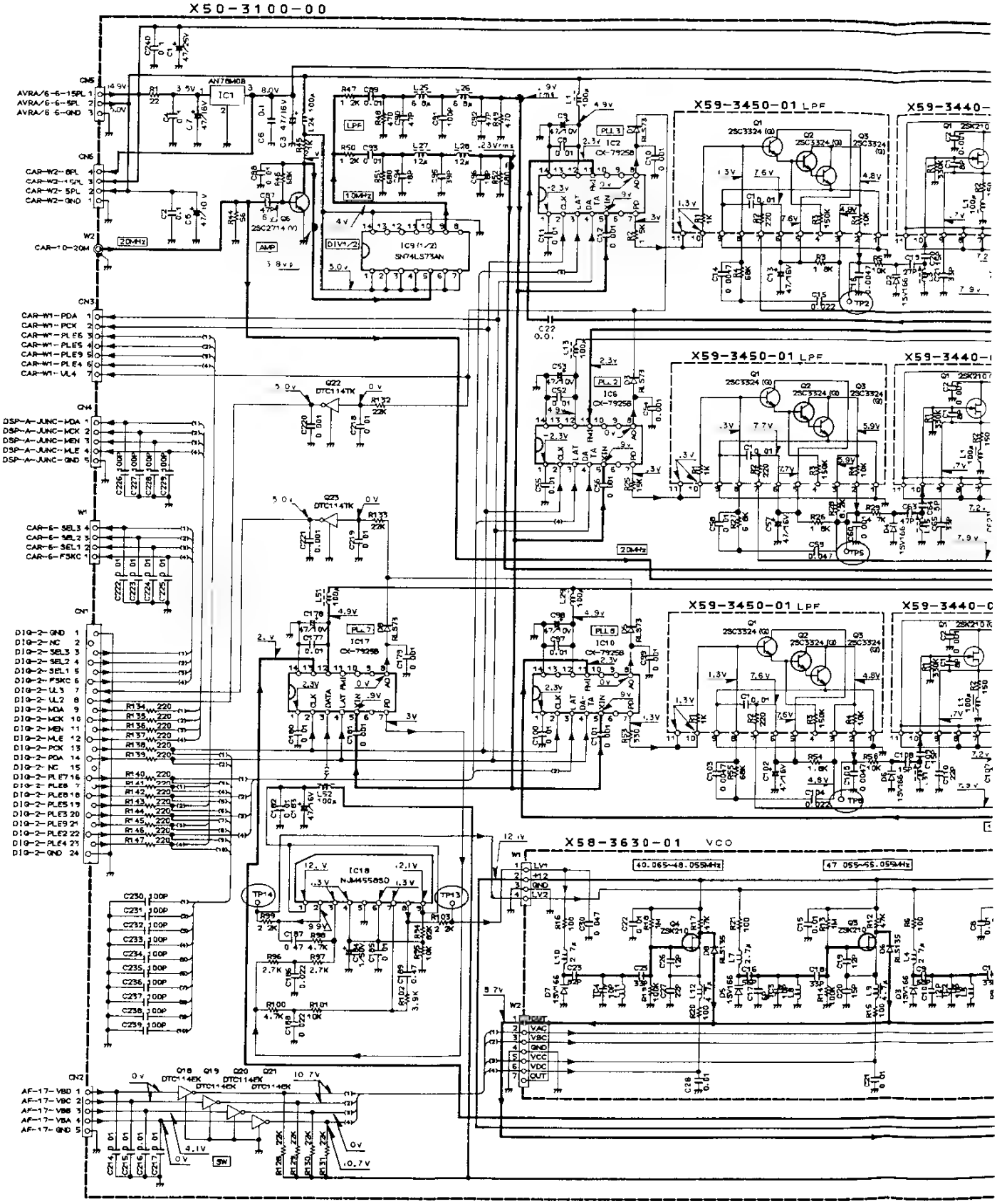
CIRCUIT DIAGRAM TS-950S/SD

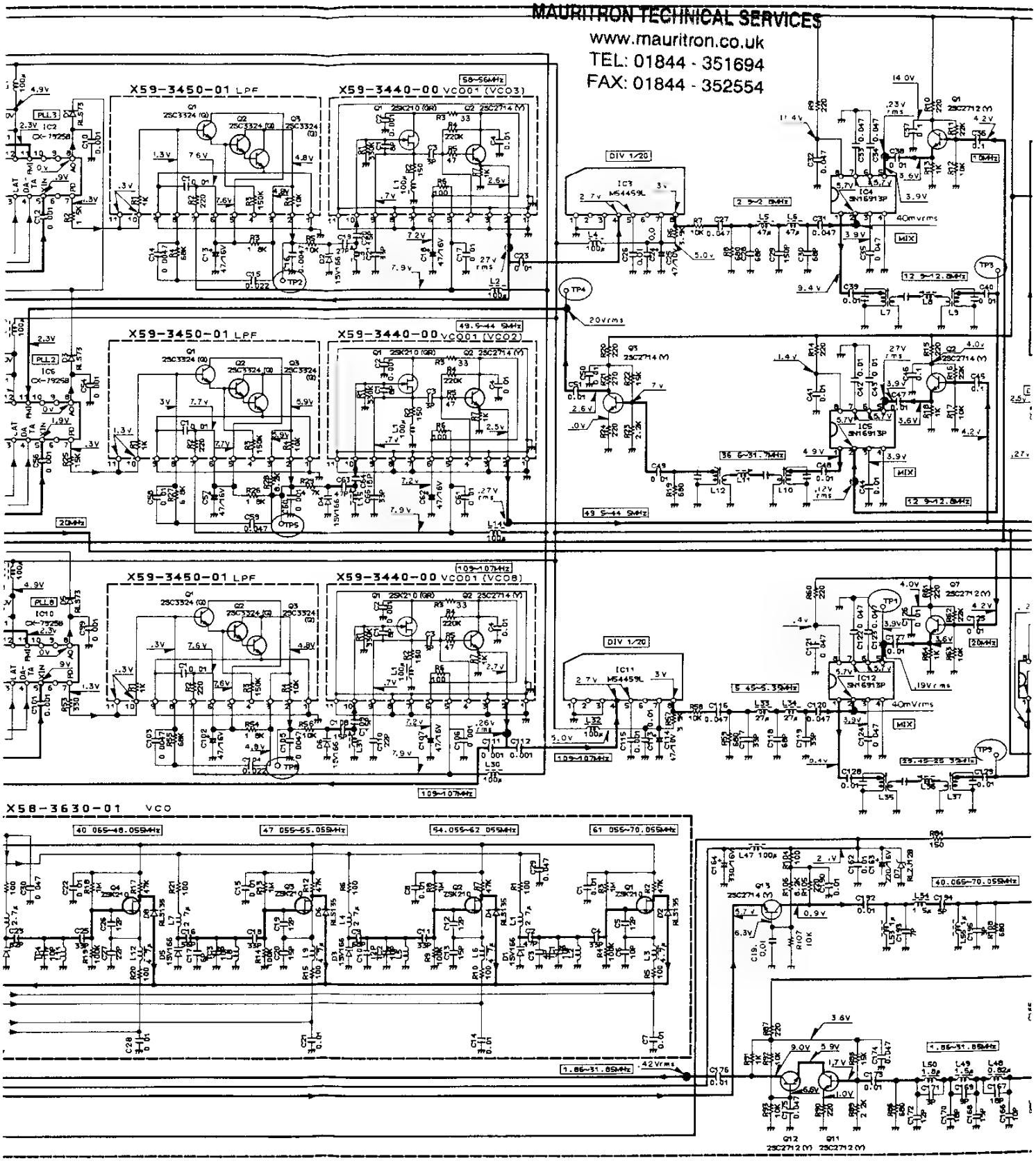


IC1	SN74LS390NS
IC2	MF 0CCWM
IC3	MF5CWM
IC4~6,10	TC40668F
IC7, 8	NJM4558M
IC9	TC4538BF
IC11, 3	CXD1225M
IC12	SN76514N
IC14	AN78N10
IC 5	AN78N05
Q1,7,10,11, 5,20,38,41~47	2SC2712(Y)
Q2,4,16,17,52	DTC124EK
Q3,5,13,14,18,19,21~23,48,5	DTA124EK
Q6,8,9,12	2SD 757K
Q24~27,50	DTC1 4EK
Q28	DTC1 4TK
Q29~31	2SC3324(G)
Q32~36,39	2SC2714(Y)
Q37	2SC2996(Y
Q40	2SK210(GR)
Q49	2SA1162(Y)
D1,6,1 ,12,,4,22,23	DAN202(K
D2,4 ,7~9, 3, 15~ 7,21,25,26 31~34	R_S73
D3,5, 0,19	DAP202(K)
D24	RLZJ-28
D27	R_ZJ9.18
D28~30	HSM88AS

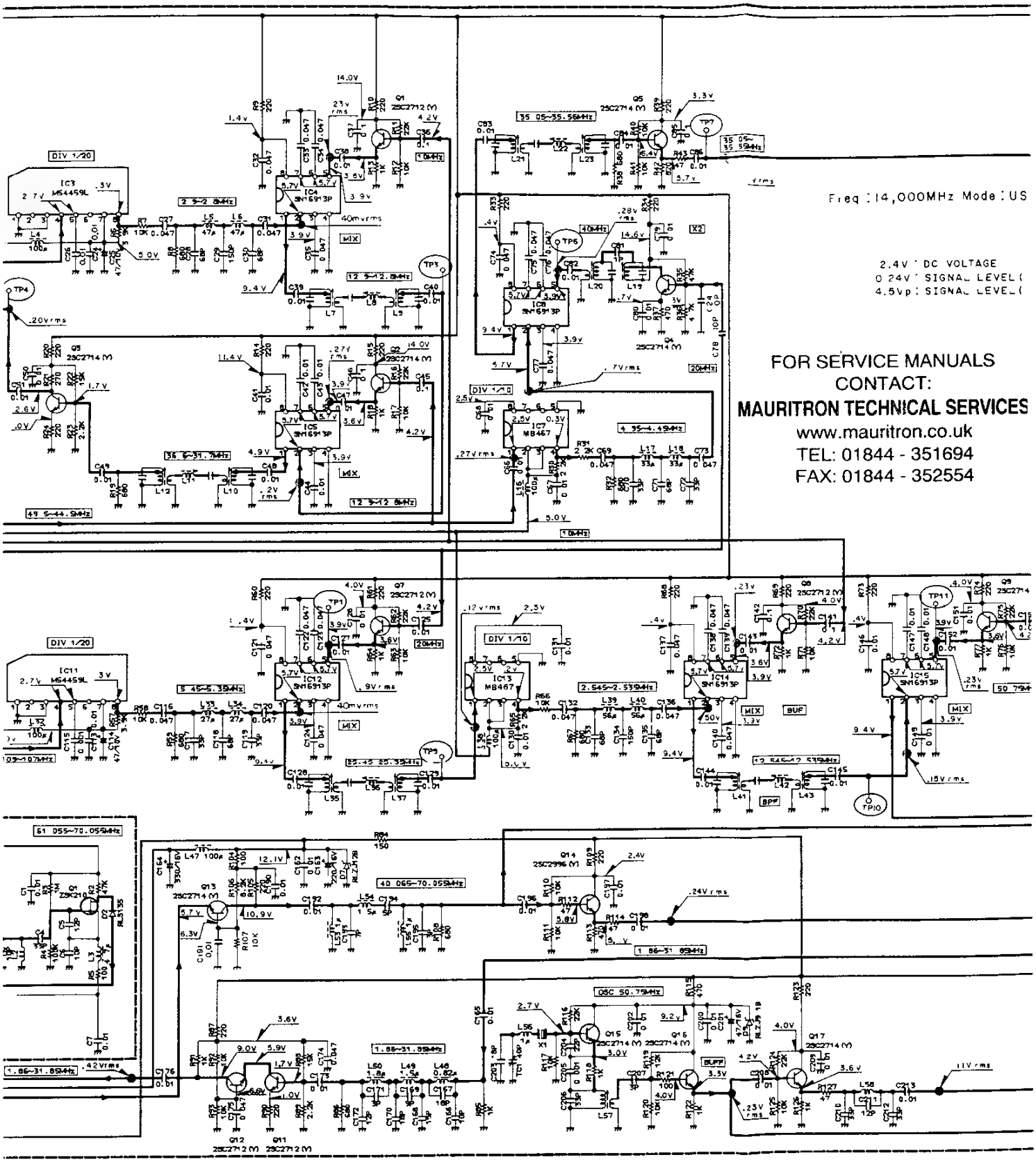
TS-950S/SD CIRCUIT DIAGRAM

PLL UNIT (X50-3100-00)





8, 11, 12	: 2SC2712 (Y)	D1, 3, 5, 6	: RLS73
9, 10, 13, 15-17	: 2SC2714 (Y)	D2, 4, 8	: 1SV166
	: 2SC2786 (Y)	D7	: RLZJ12B
21	: DTC114EK	D9	: RLZJ9.1B
23	: DTC114TK		


Freq : 14,000MHz Mode : US
2.4V : DC VOLTAGE
0.24V : SIGNAL LEVEL (
4.5Vp : SIGNAL LEVEL (
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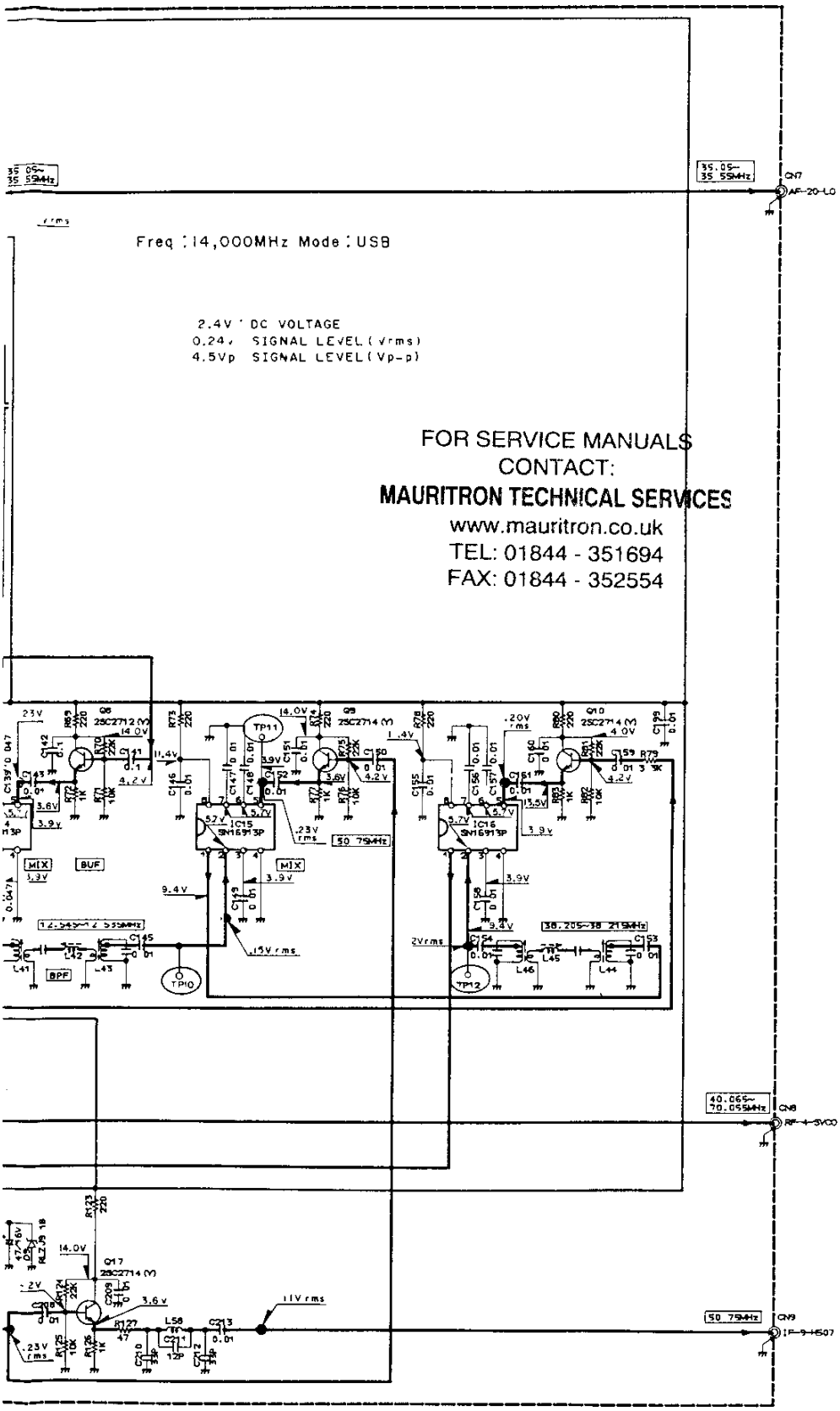
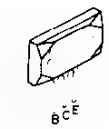
CONTACT:
MAURITRON TECHNICAL SERVICES
www.mauritron.co.uk
TEL: 01844 - 351694
FAX: 01844 - 352554

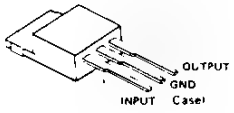


2SC2712
2SC2714
DTC114EK
DTC114TK

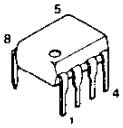
2SC2996



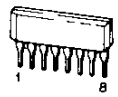
AN78M08H
µPC78M08H



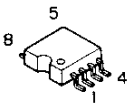
SN16913P



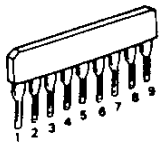
M54459L



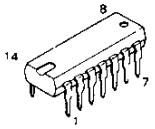
MB467



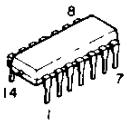
NJM4558SD



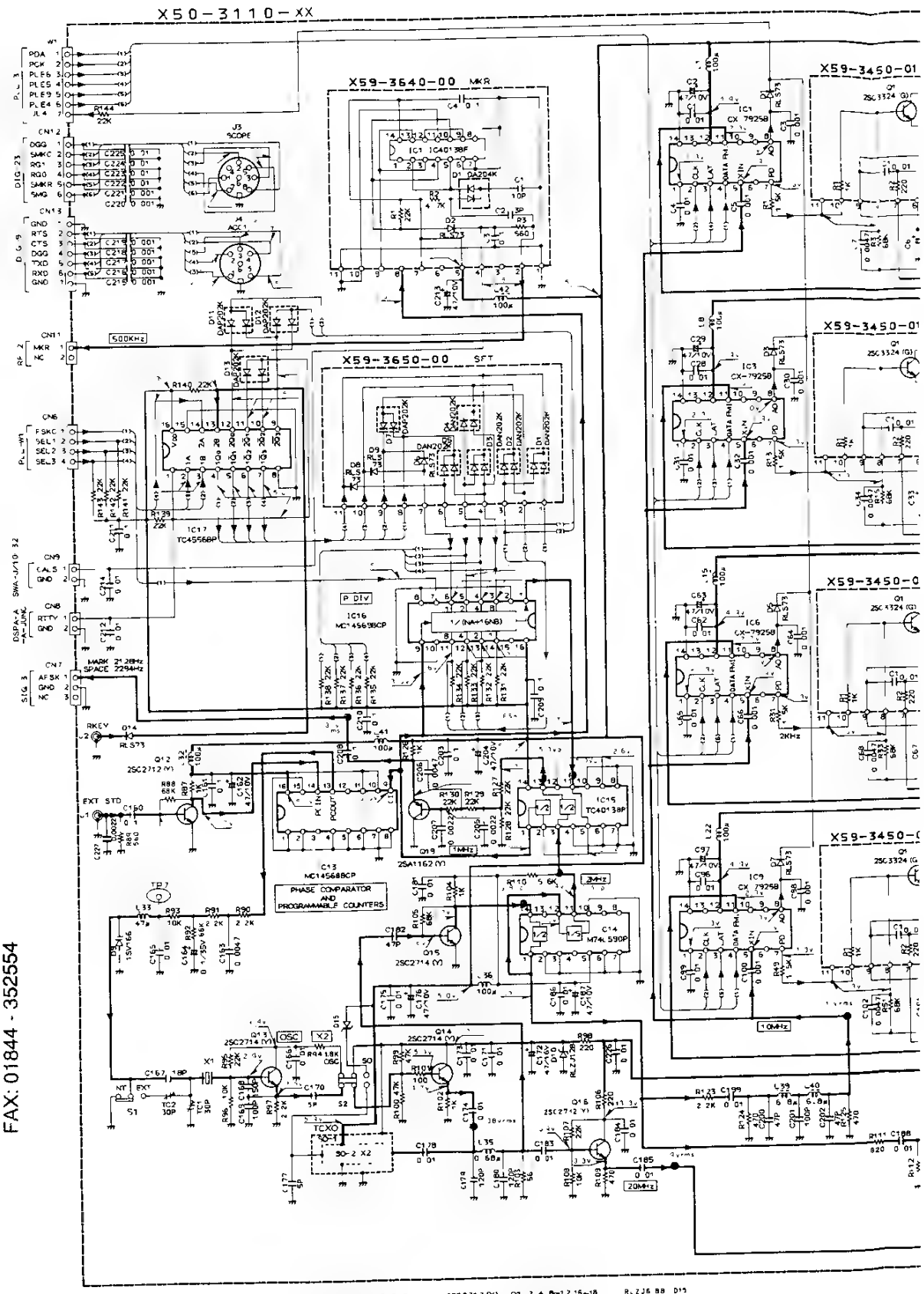
SN74LS73AN



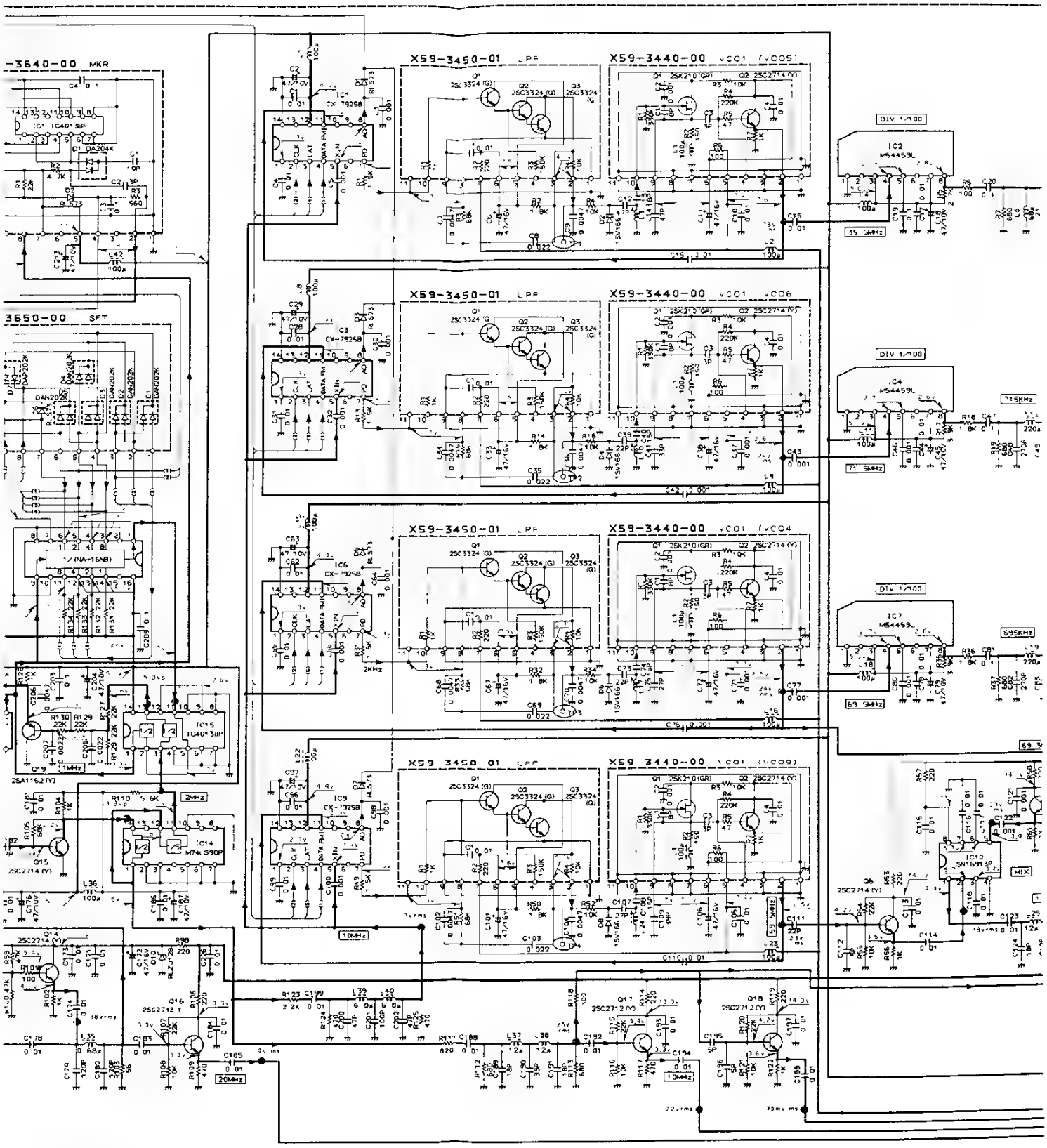
CX-7925B



CAR UNIT (X50-3110-XX) -00 : TS-950 -01 : TS-950SD

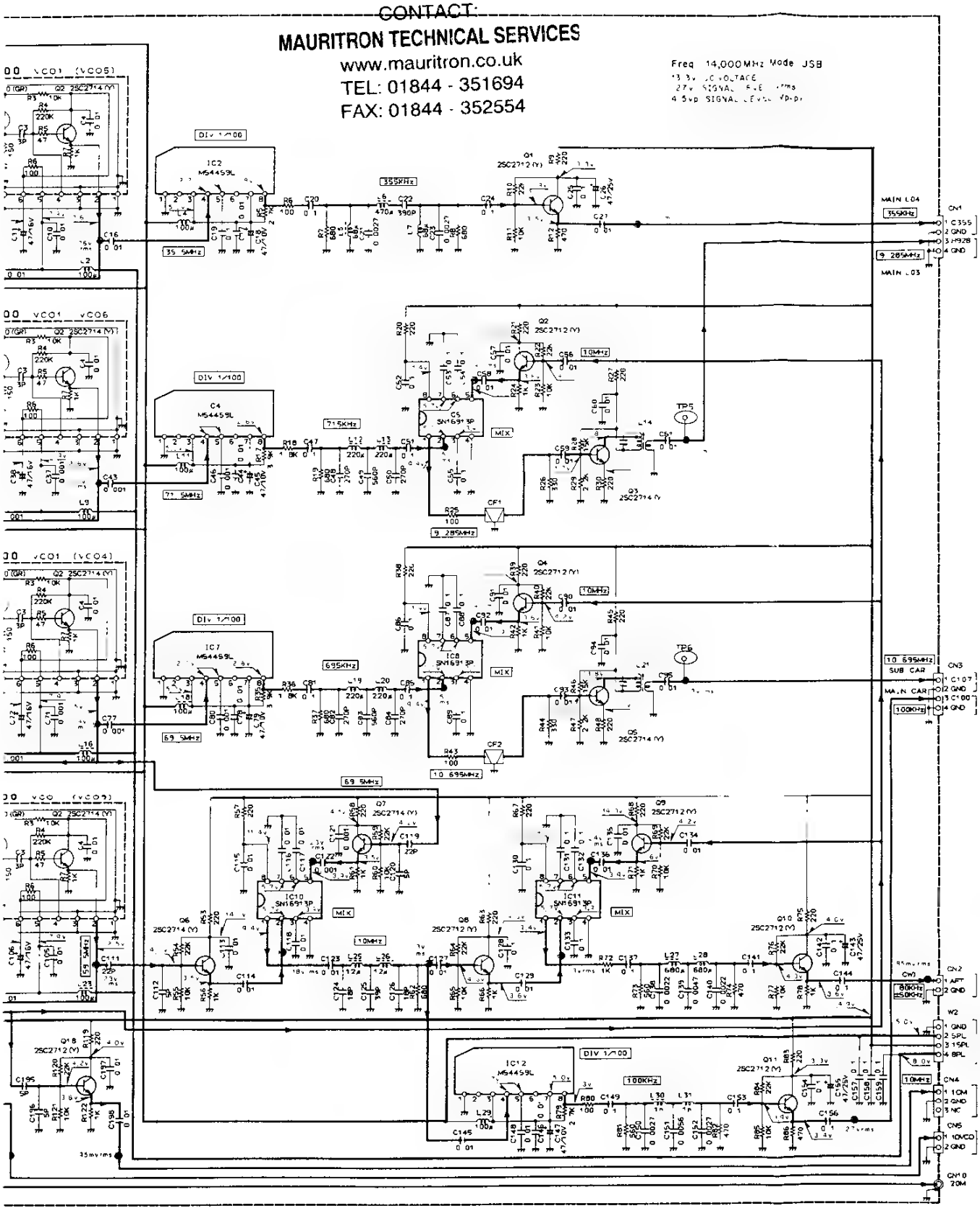


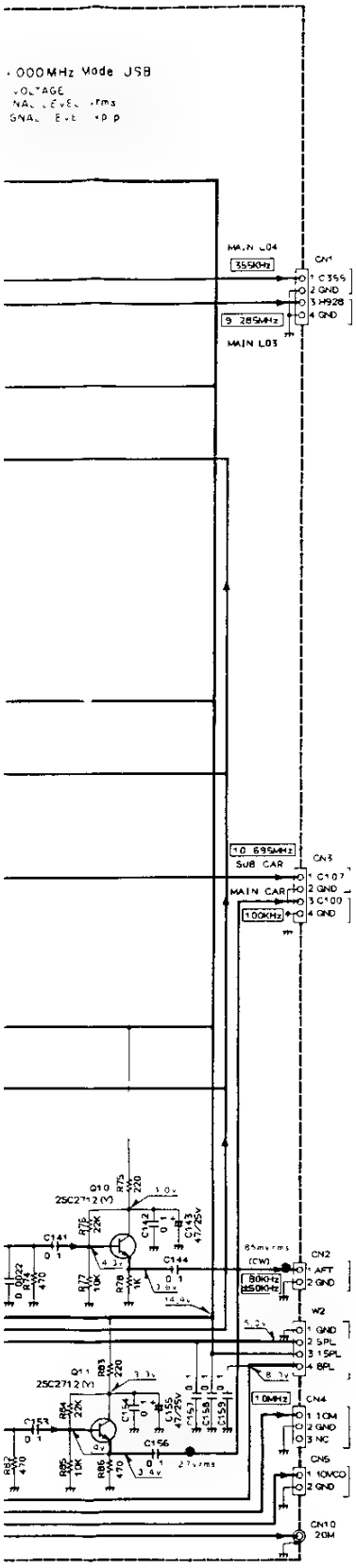
-01 : TS-950SD



9	2SC2712 (Y)	Q1, 2, 4, 8~12, 16~18	RLZJ6.8B	D15
12	2SC2714 (Y)	Q3, 5~7, 13~15		
14	2SA1162 (Y)	Q19		

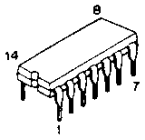
RLS73	D1, 3, 5, 7, 14
1SV166	D2, 4, 6, 8, 9
RLZ5.1B	D10
DAP202K	D11~13



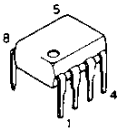


2SA1162
2SC2712
2SC2714

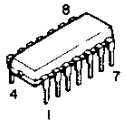
TC4013P



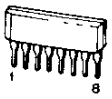
SN16913P



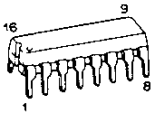
CX-7925B



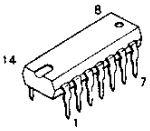
M54459L



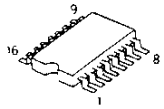
MC14568BCP
MC14569BCP



M74LS90P
SN74LS90N

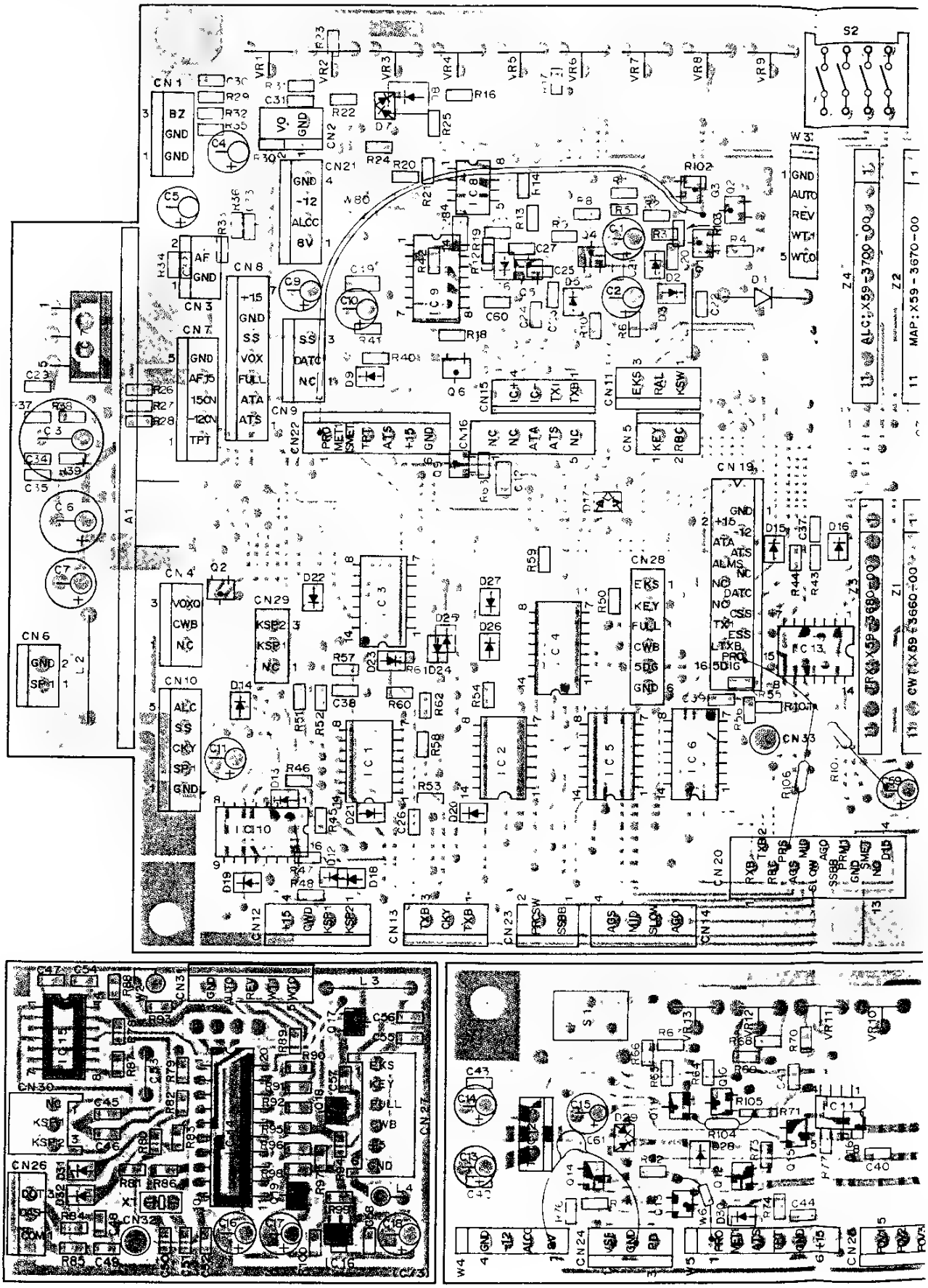


TC4556BP

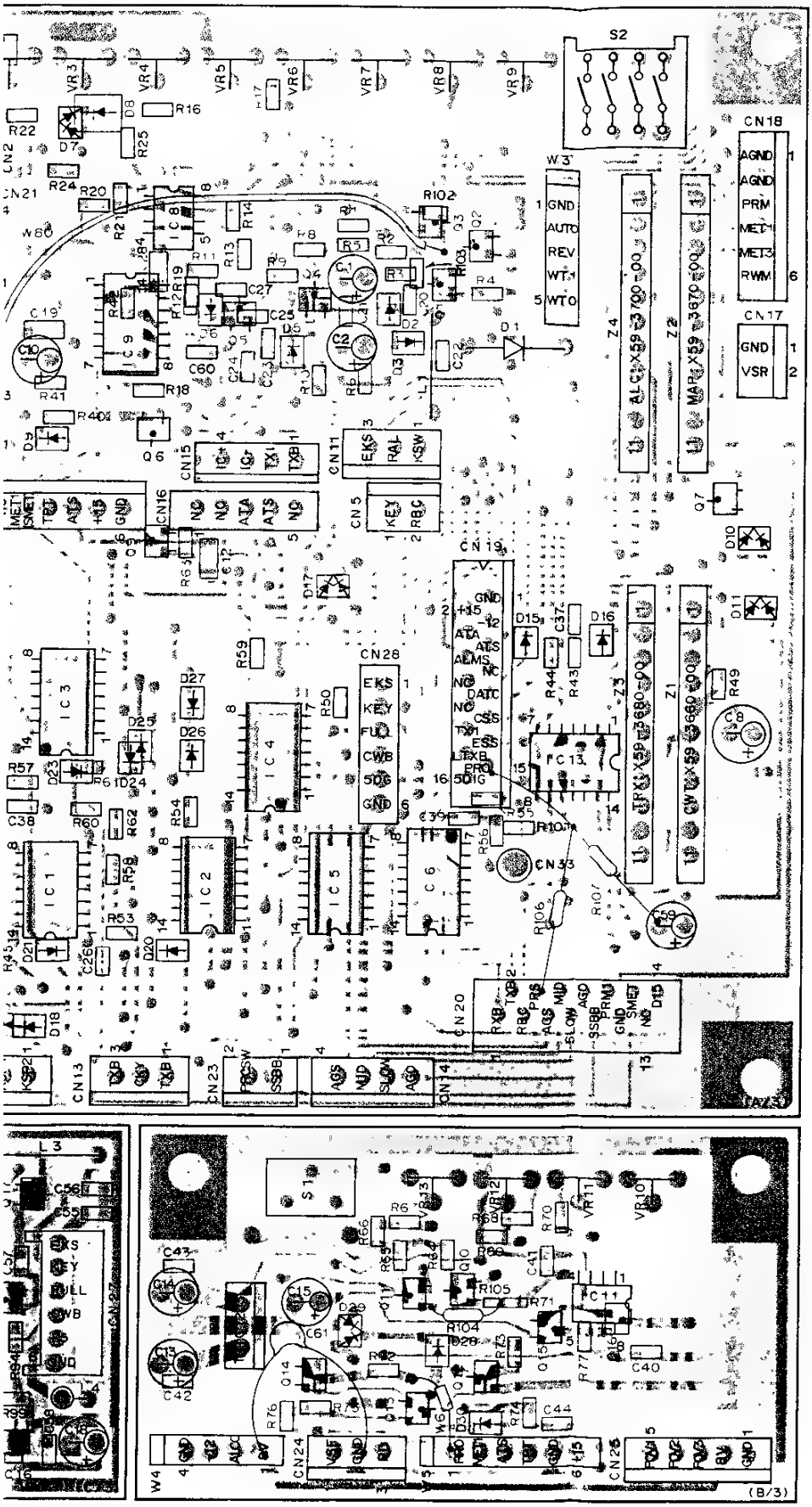


TS-950S/SD PC BOARD VIEWS

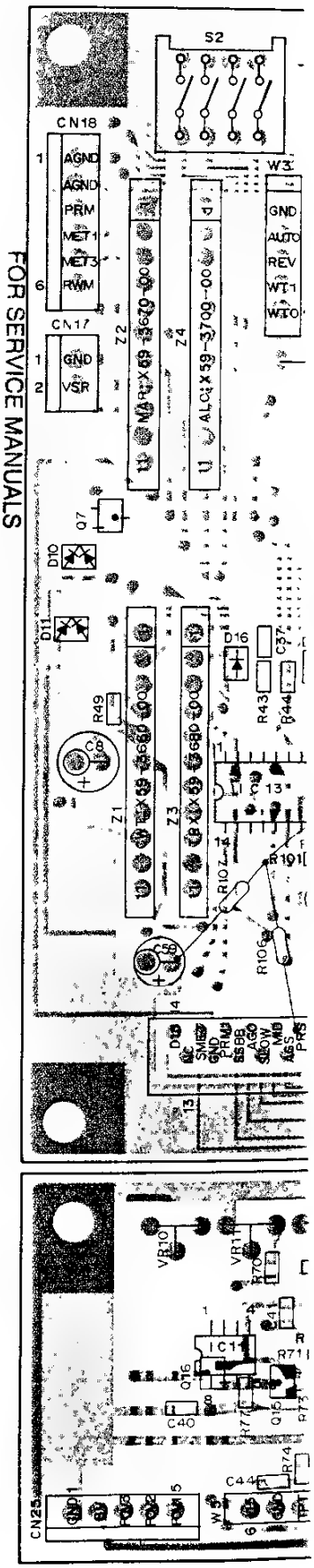
CONTROL UNIT (X53-3230-00) Component side view



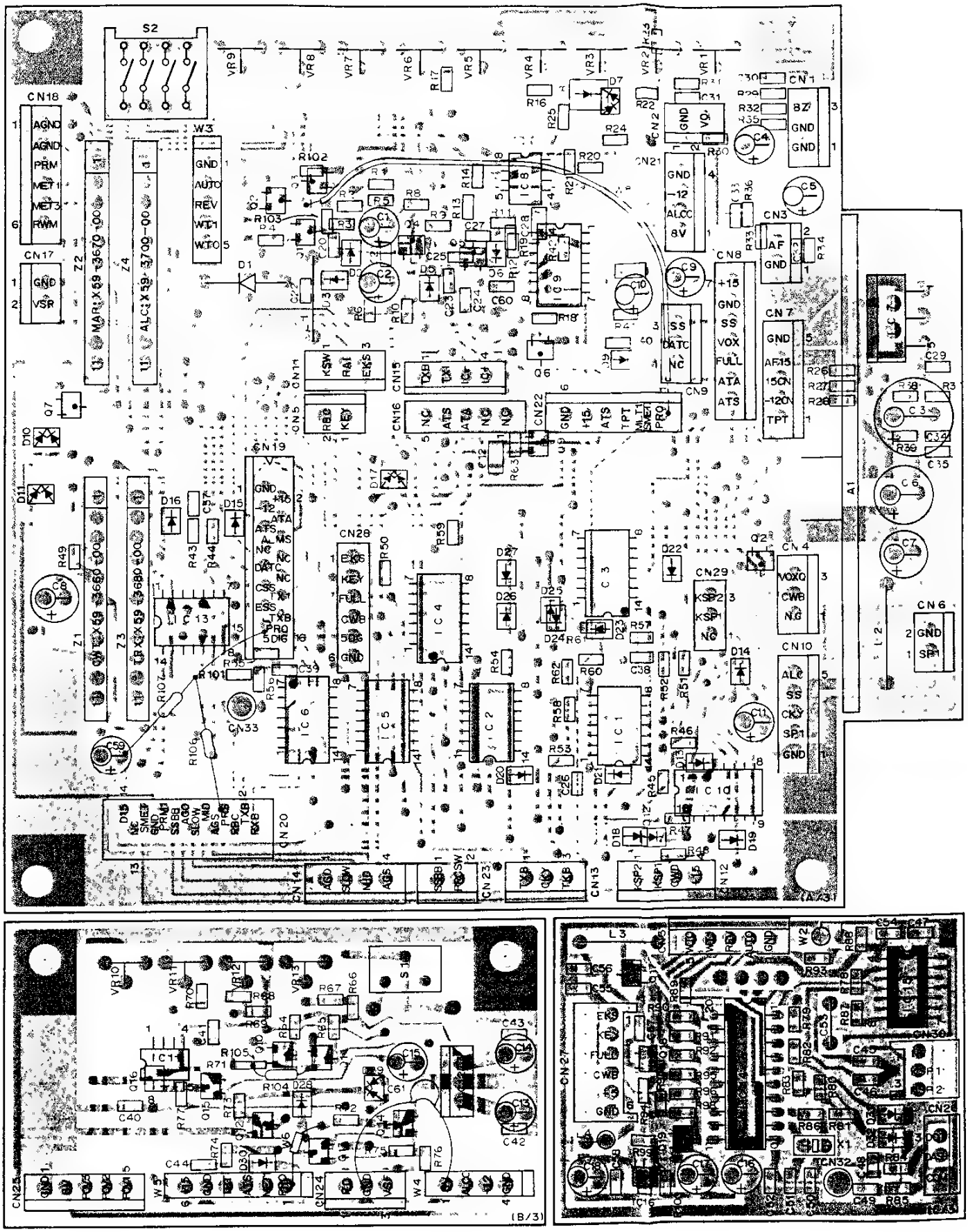
ponent side view

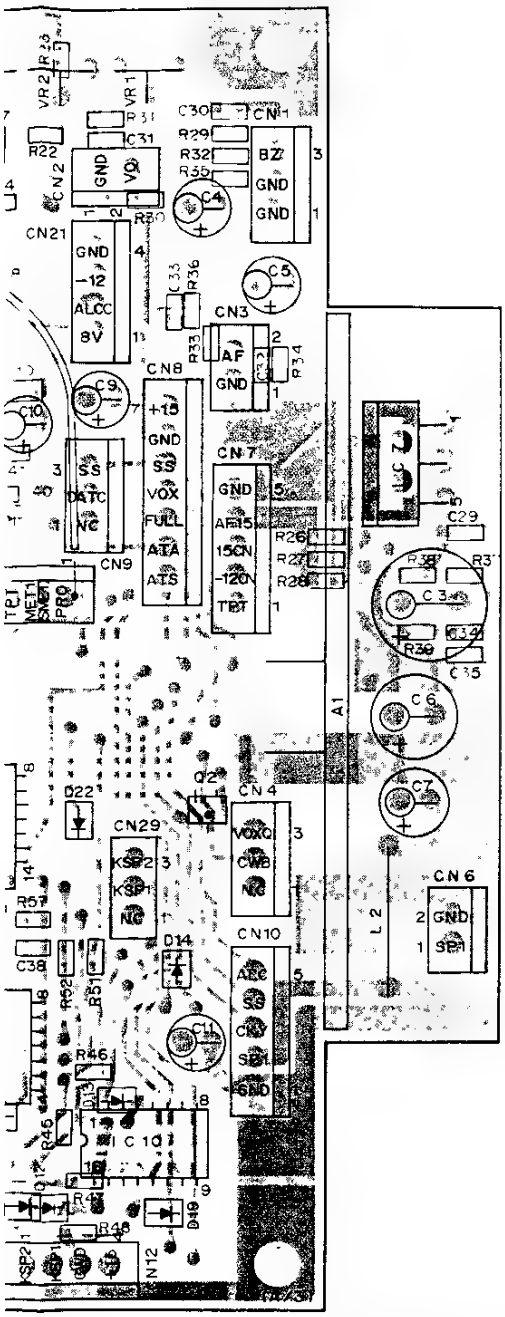


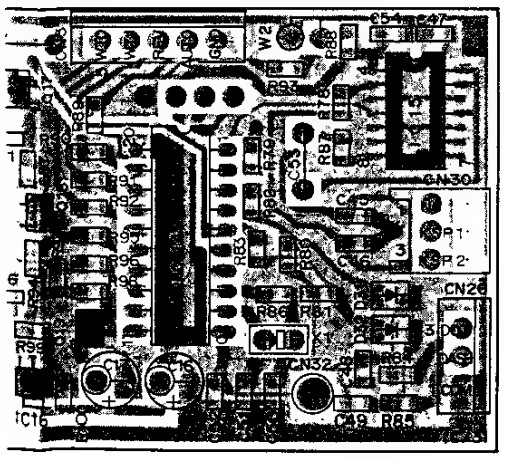
CONTROL UNIT (X53-3230



CONTROL UNIT (X53-3230-00) Foil side view







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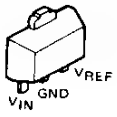
DTA124EK
DTC114TK
DTC124EK
DTC144EK
DTC144WK

2SK208

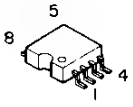
M51951BML



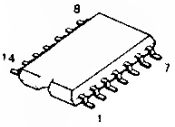
AN78N08

µPC2002V

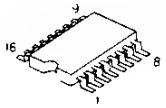
NJM4558M



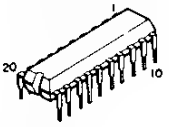
TC4011BF
TC4066BF
TC4069UBF



TC4538BF



µPD7564CS-114



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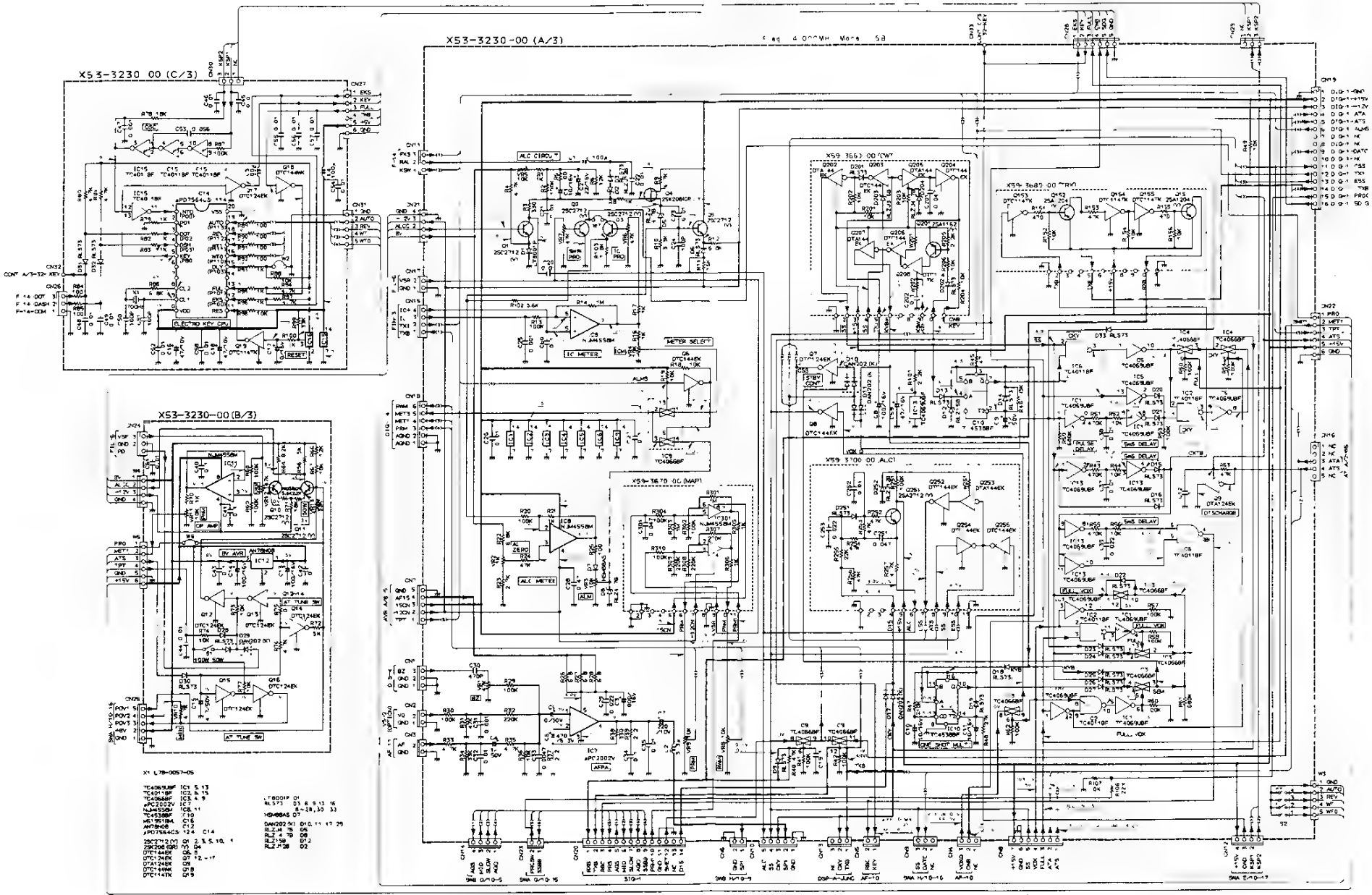
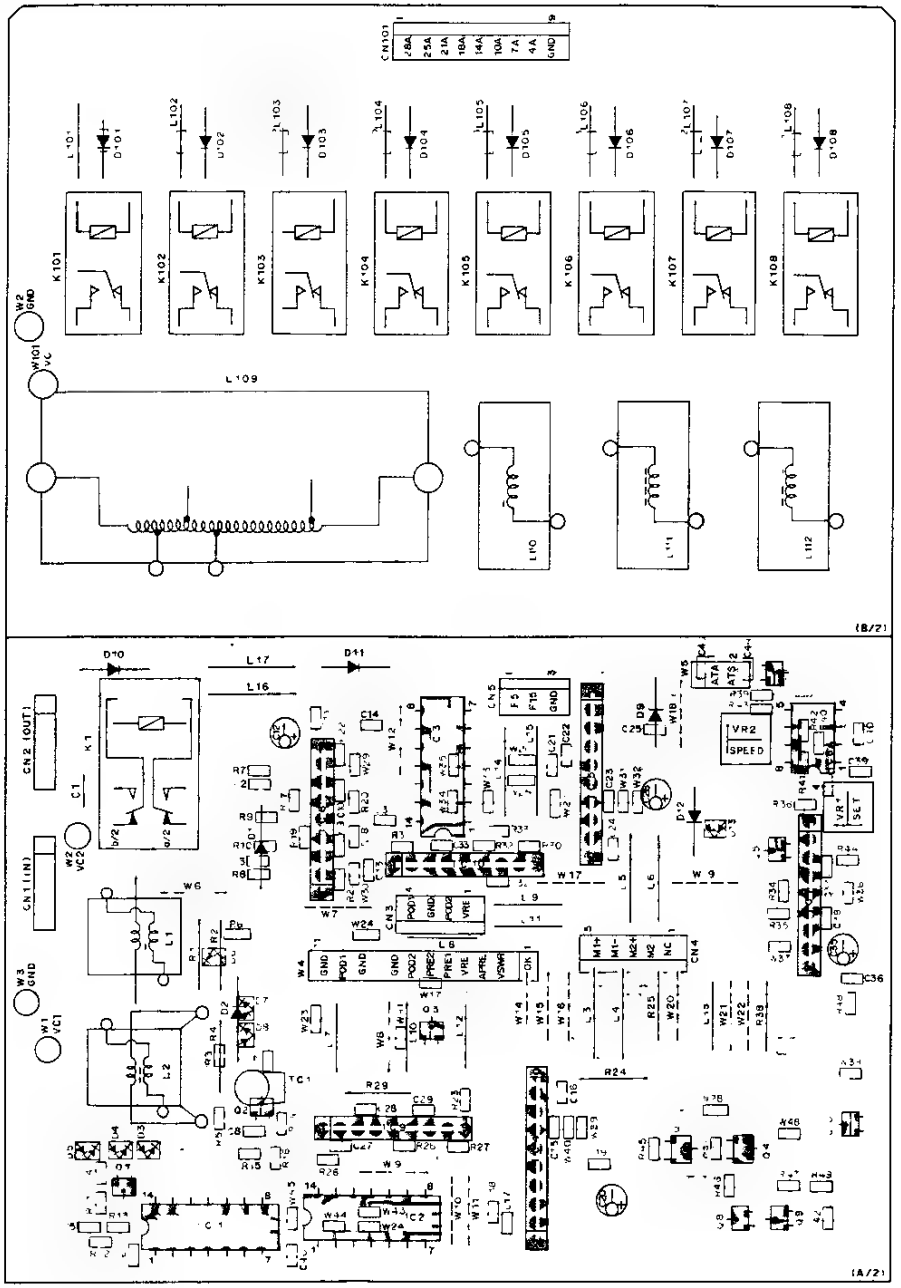
CONTROL UNIT (X53-3230-00)

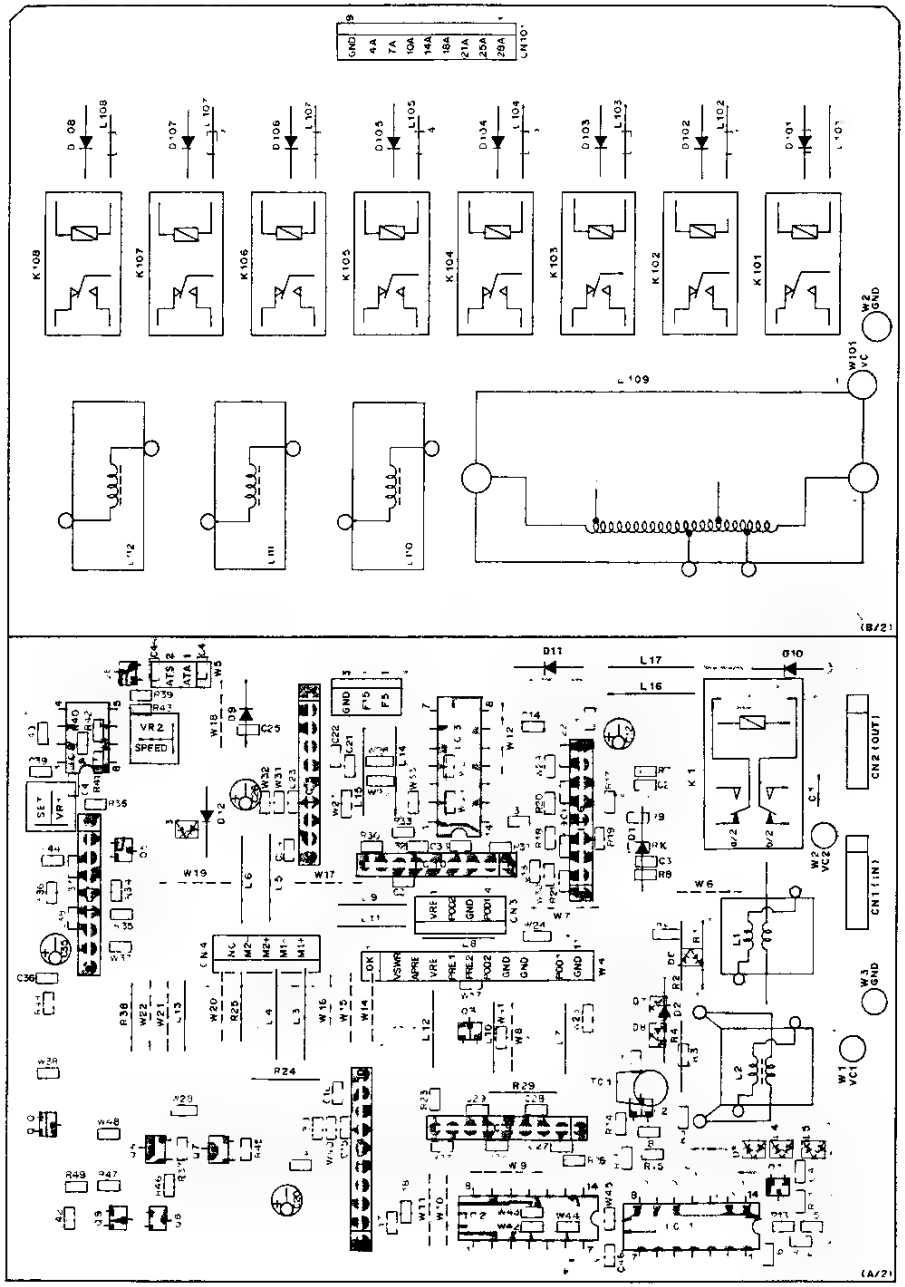


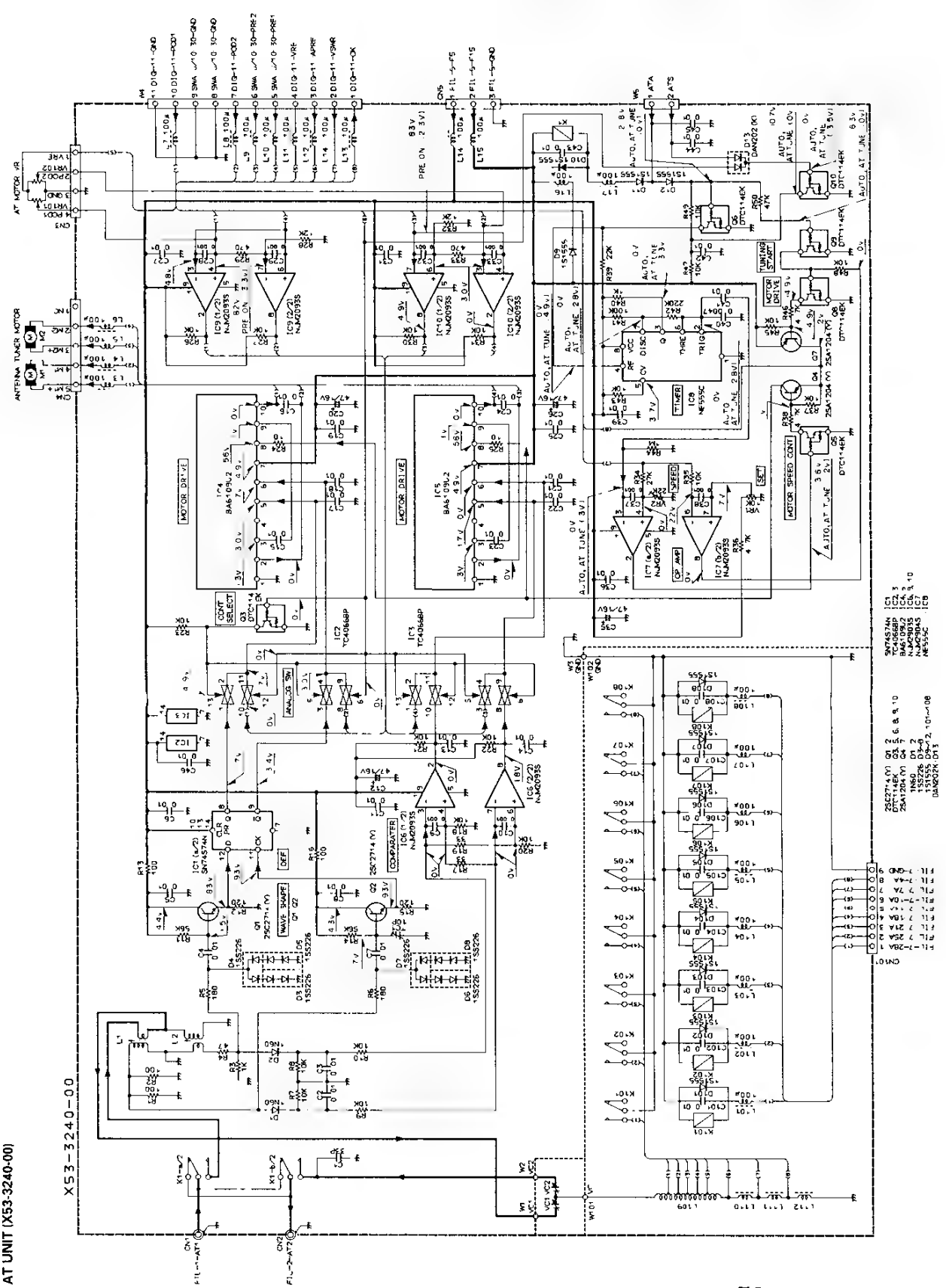
TS-950S/SD PC BOARD VIEWS

AT UNIT (X53-3240-00) Component side view



AT UNIT (X53-3240-00) Foil side view





AT UNIT (X53-3240-00)

X53-3240-00

2SC2714
DTC114EK

2SA1204

NE555P

NJM2903S
NJM2904S

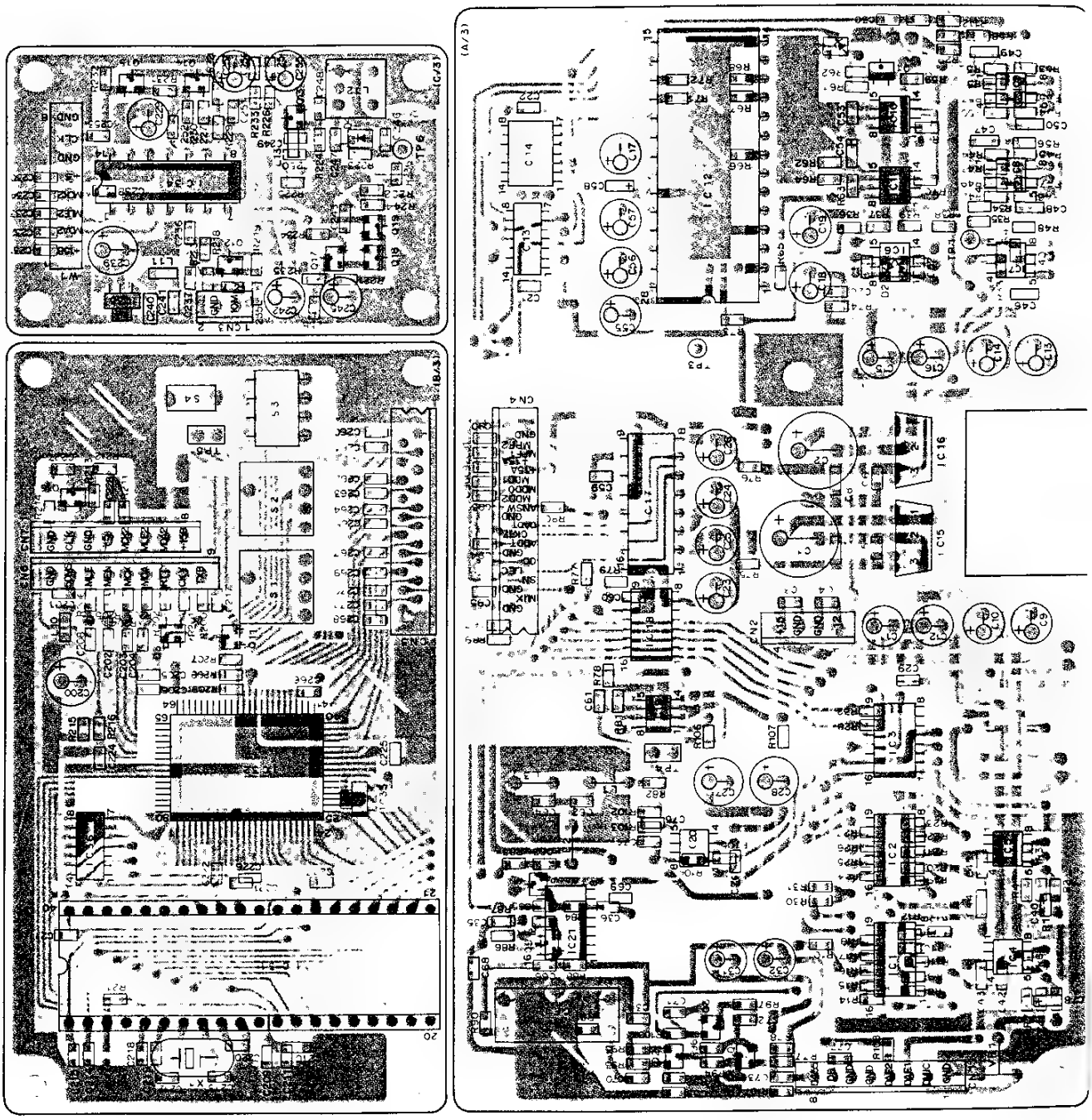
BA6109U2

TC4066BP

SN74S74N

TS-950S/SD PC BOARD VIEWS

DSP UNIT (X53-3260-00) Component side view



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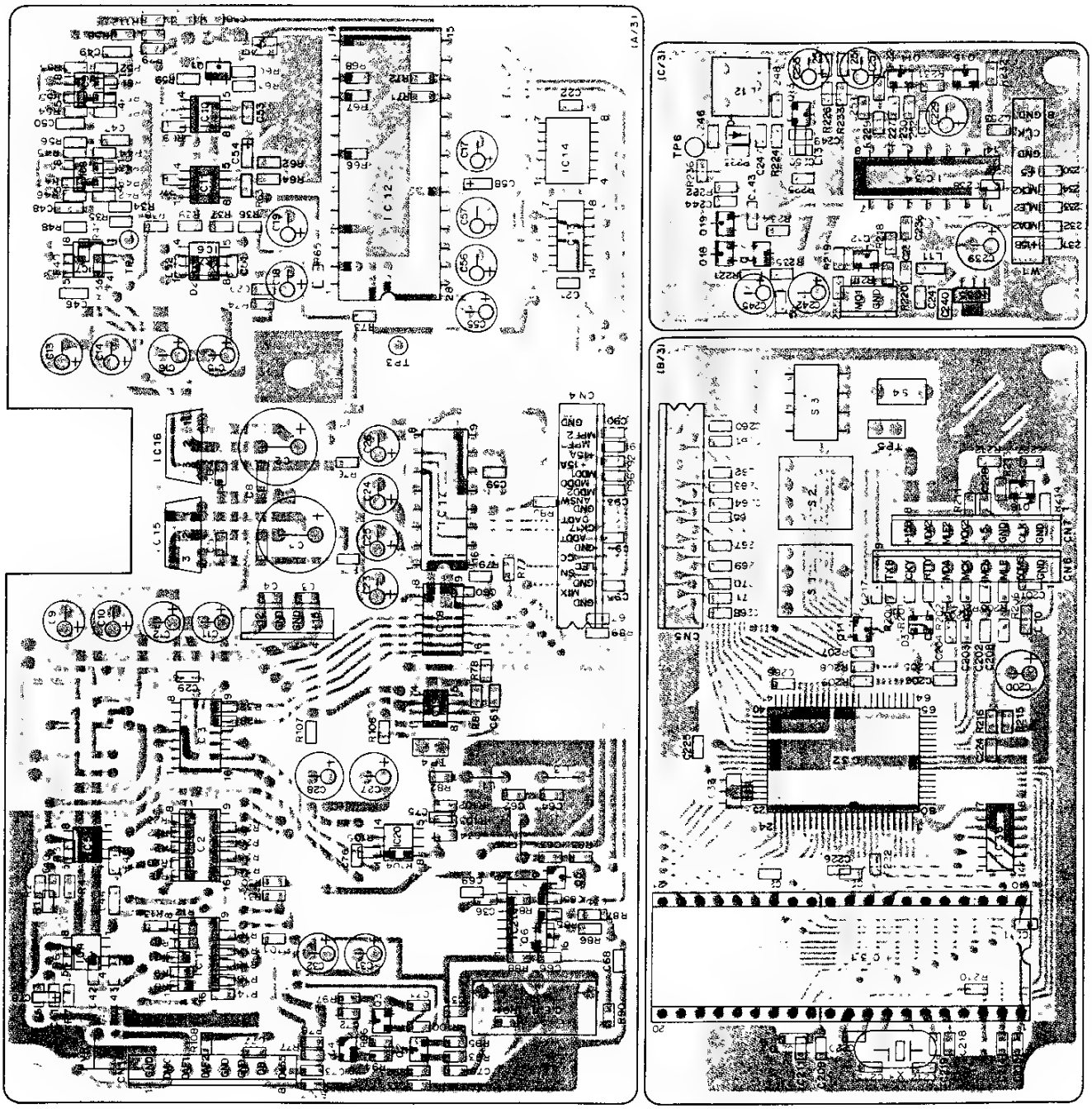
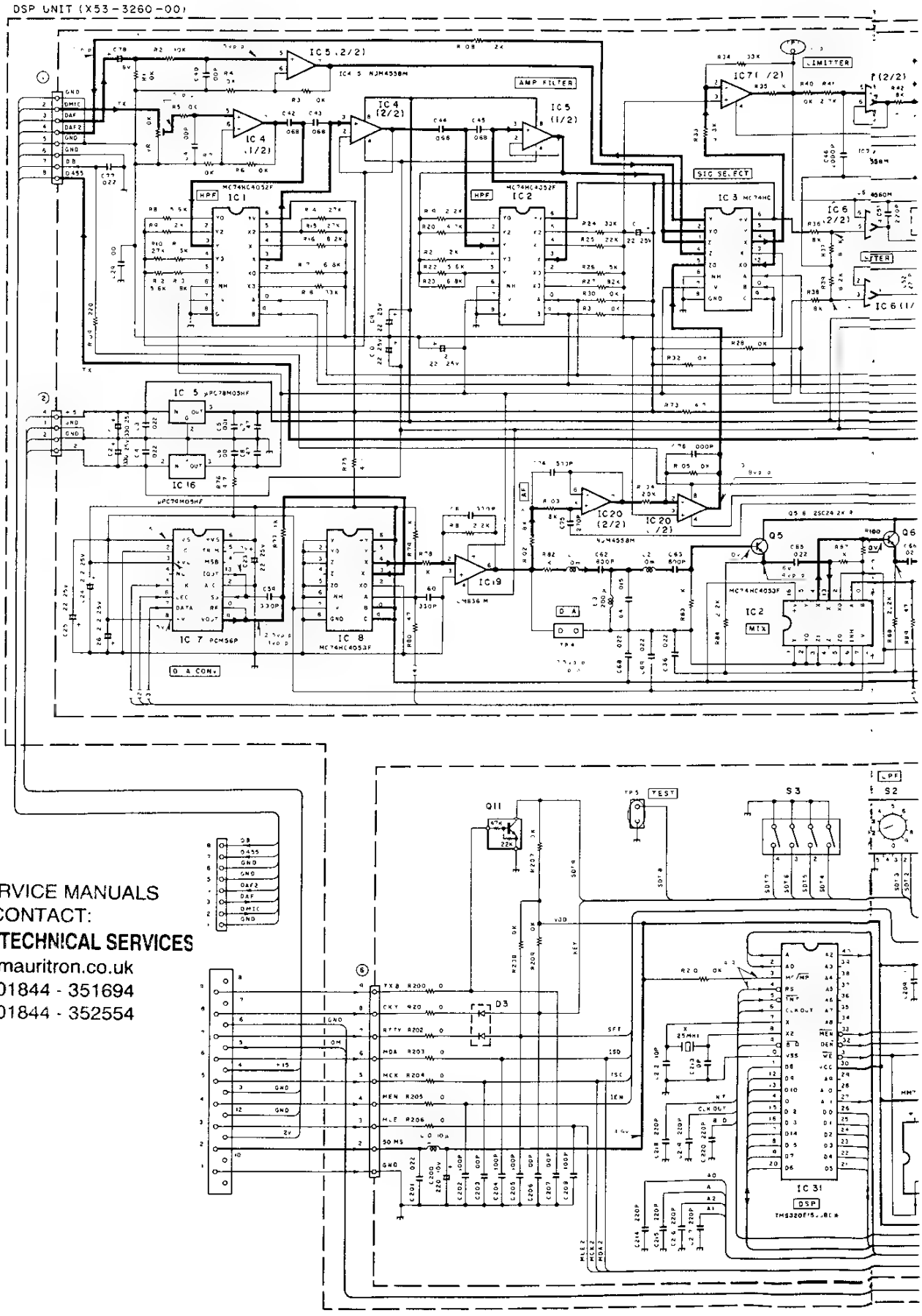
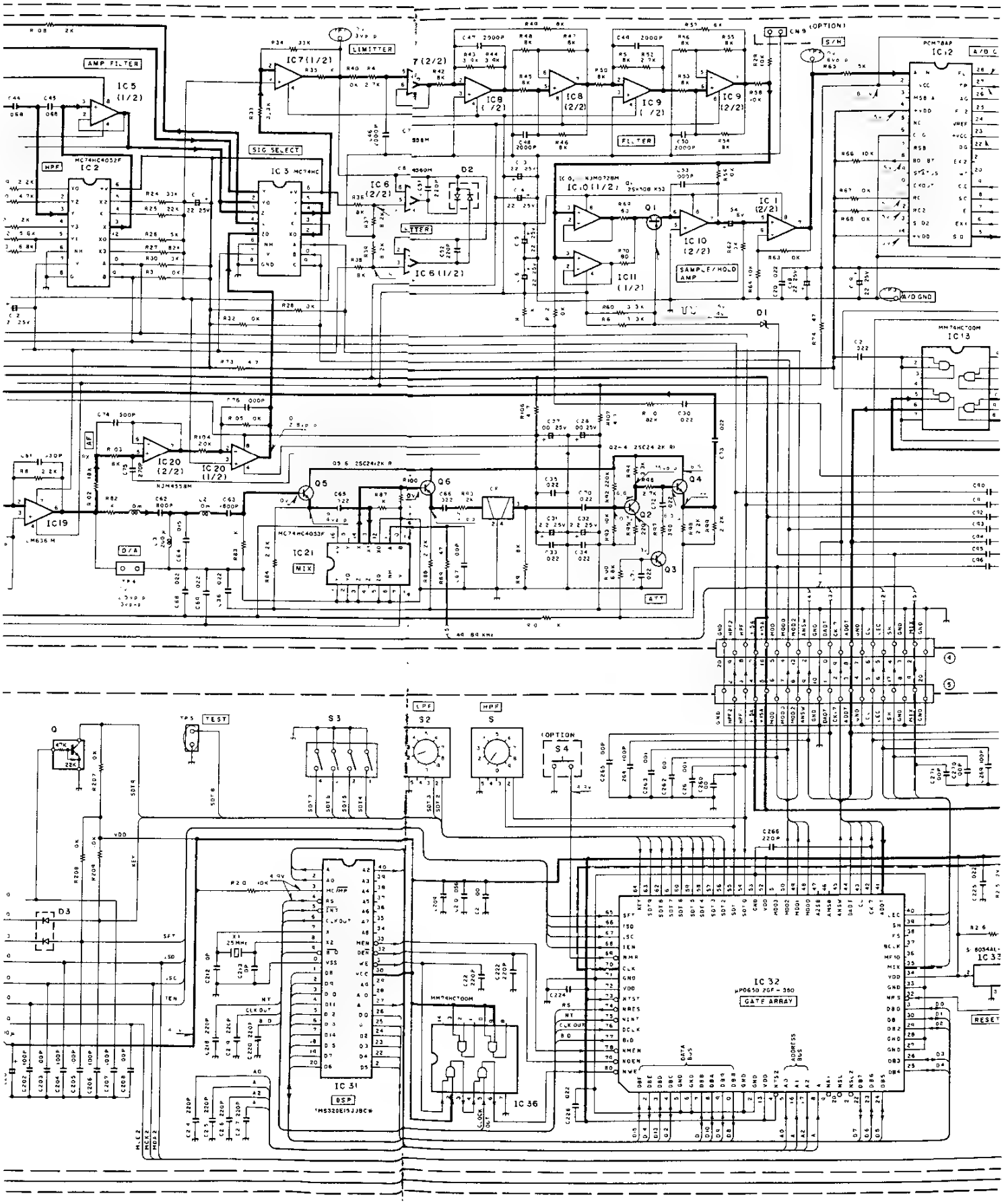
FAX: 01844 - 352554

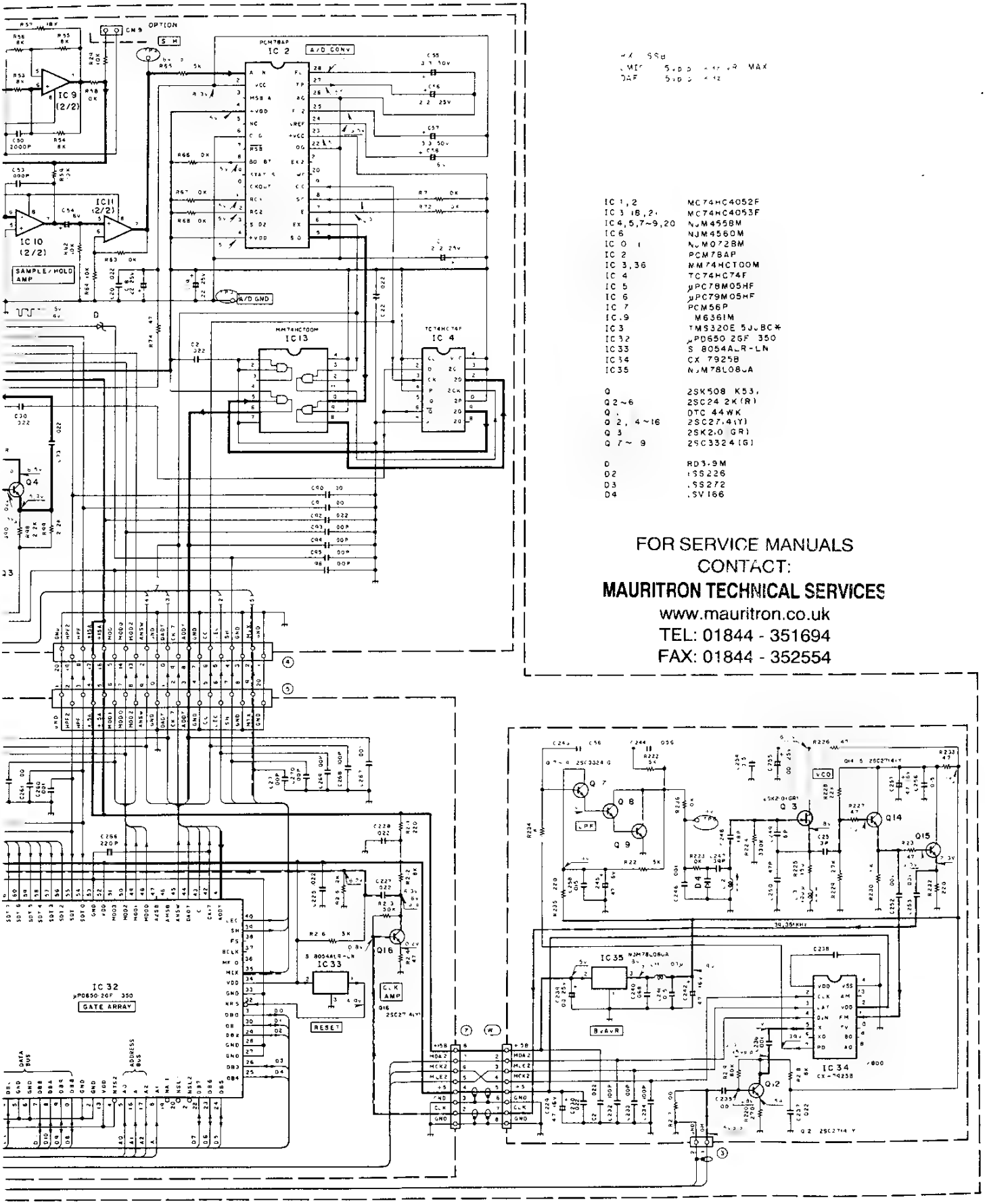
DSP UNIT (X53-3260-00) Foil side view



DSP UNIT (X53-3260-00) : TS-950SD




AMP FILTER
IC5 (1/2)
HPF
IC2
SIG SELECT
IC3
LIMITTER
IC7(1/2)
IC7(2/2)
IC8 (1/2)
IC8 (2/2)
IC9 (1/2)
IC9 (2/2)
FILTER
IC6 (2/2)
IC6(1/2)
D2
IC10 (2/2)
IC11 (1/2)
IC1 (2/2)
Q1
SAMPLE/HOLD AMP
CN9 (OPTION)
S/H
PCM78AP
IC12
A/D GND
D1
MM74HC700M
IC13
IC20 (2/2)
IC20 (1/2)
NJM4558M
IC19
LM636 M
D/A
IC21
MIX
Q5
Q6
Q4
Q2
Q3
ATT
LPF
HPF
S3
S2
S
(OPTION)
S4
TEST
Q
D3
IC31
DSP
IC32
μPD650 2GF-380
GATE ARRAY
IC36
RESET



IC 1,2	MC74HC4052F
IC 3 18,24	MC74HC4053F
IC4,5,7~9,20	NJM4558M
IC 6	NJM4560M
IC 0 1	NJM0728M
IC 2	PCM78AP
IC 3,36	MM74HCT00M
IC 4	TC74HC74F
IC 5	μPC78M05HF
IC 6	μPC79M05HF
IC 7	PCM56P
IC.9	M6361M
IC 3	TMS320E 5JLBC*
IC 32	μPD650 26F 350
IC 33	S 8054ALR-LN
IC 34	CX 7925B
IC 35	NJM78L08UA
Q	2SK508 K53,
Q 2~6	2SC24 2K(R)
Q 7	DTC 44WK
Q 2, 4~16	2SC27.4(Y)
Q 3	2SK2.0 GR)
Q 7~ 9	2SC3324(G)
D	RD3.9M
D2	1SS226
D3	1SS272
D4	1SV166

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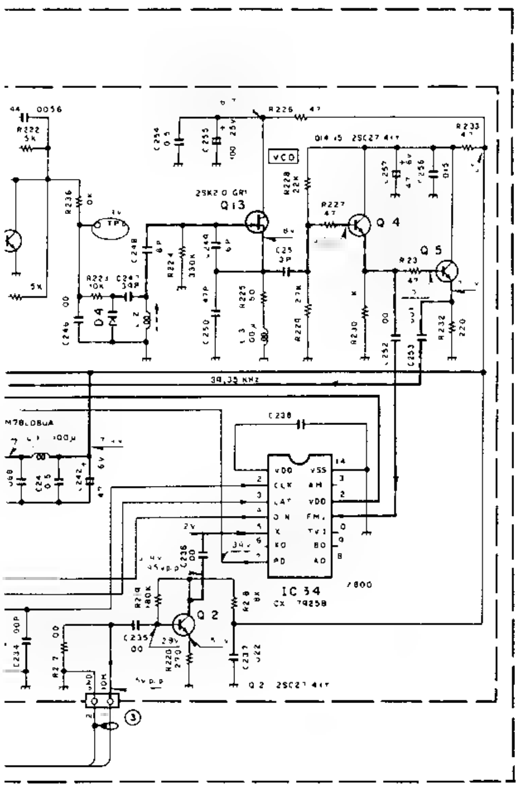
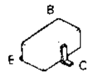
MC74HC4052F
8, 2 MC74HC4053F
7~9, 20 NJM4558M
NJM4560M
NJM072BM
PCM78AP
36 MM74HCT00M
TC74HC74F
µPC78M05HF
µPC79M05HF
PCM56P
LM636 M
TMS320E15..BC*
µPD65012GF-350
S-8054ALR LN
CX-7925B
NJM78L08JA

2SK508 (K53)
2SC2412K (R)
DTC 44WK
4~6 2SC2714 (Y)
2SK210 (GR)
9 2SC3324 (G)

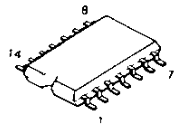
RD3-9M
1SS226
1SS272
1SV 66



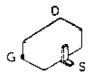
2SC2412K
2SC2714
2SC3324
DTC124WK



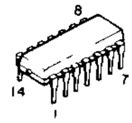
MM74HCT00M



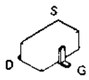
2SK210



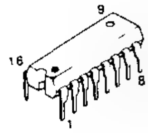
CX-7925B



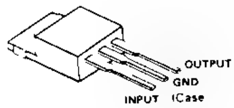
2SK508



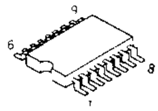
PCM56P



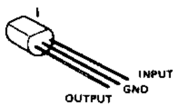
NJM78L08UA
µPC78M05HF
µPC79MO5HF



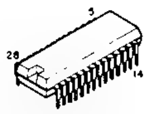
MC74HC4052F
MC74HC4053F
TC74HC74AF



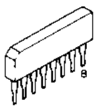
S-8054ALR-LN



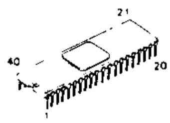
PCM78AP



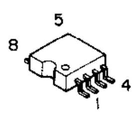
NJM072BM



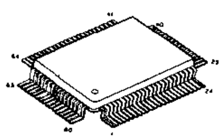
TMS320E15JJBC1



LM6361M
NJM4558M
NJM4560M



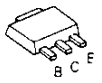
µPD65012GF-350



TS-950S/SD PC BOARD VIEWS

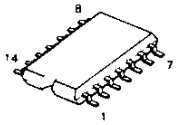
2SA1163

2SA1201

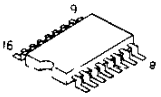


FMG1

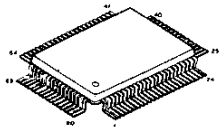
TC74HC00AF
TC74HC04AF
TC4011BF



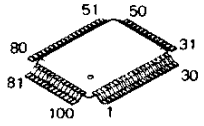
TC74HC138AF
TC74HC175AF
TC74HC574AF



647180X0FS6JBE1



MB622180PF



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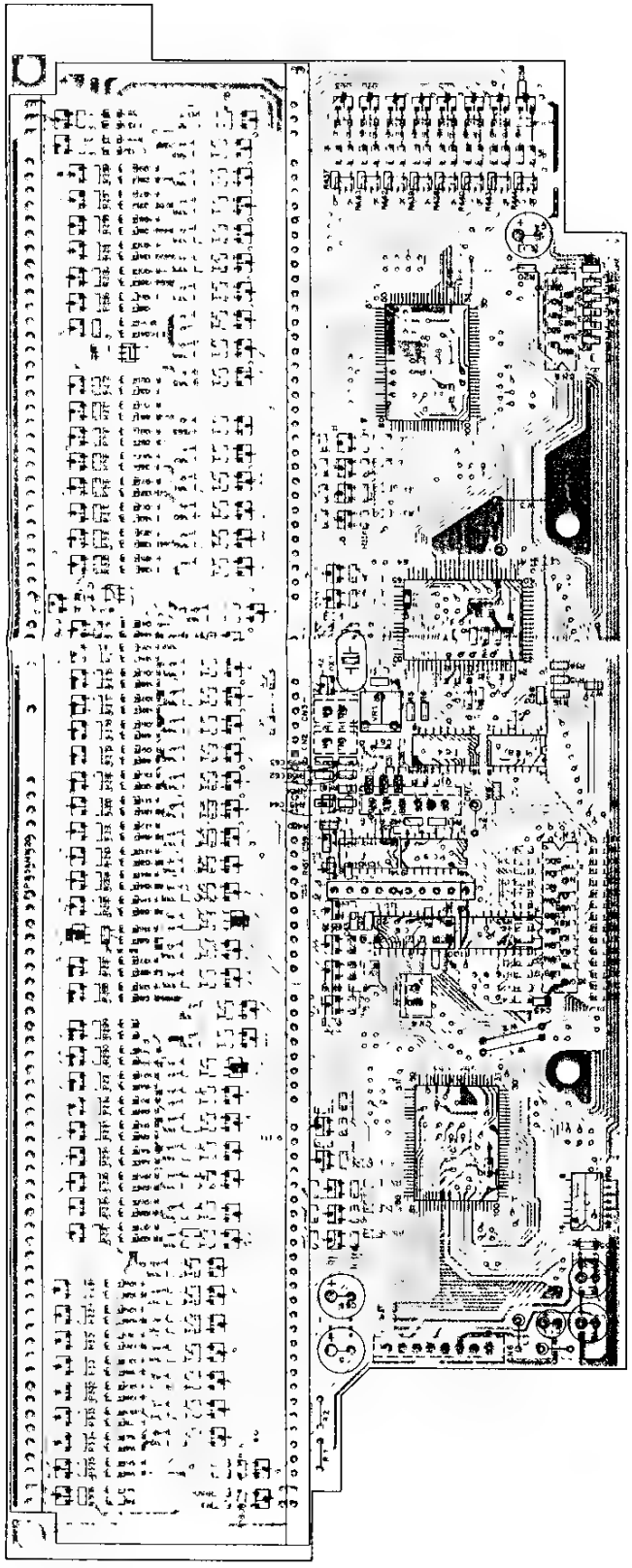
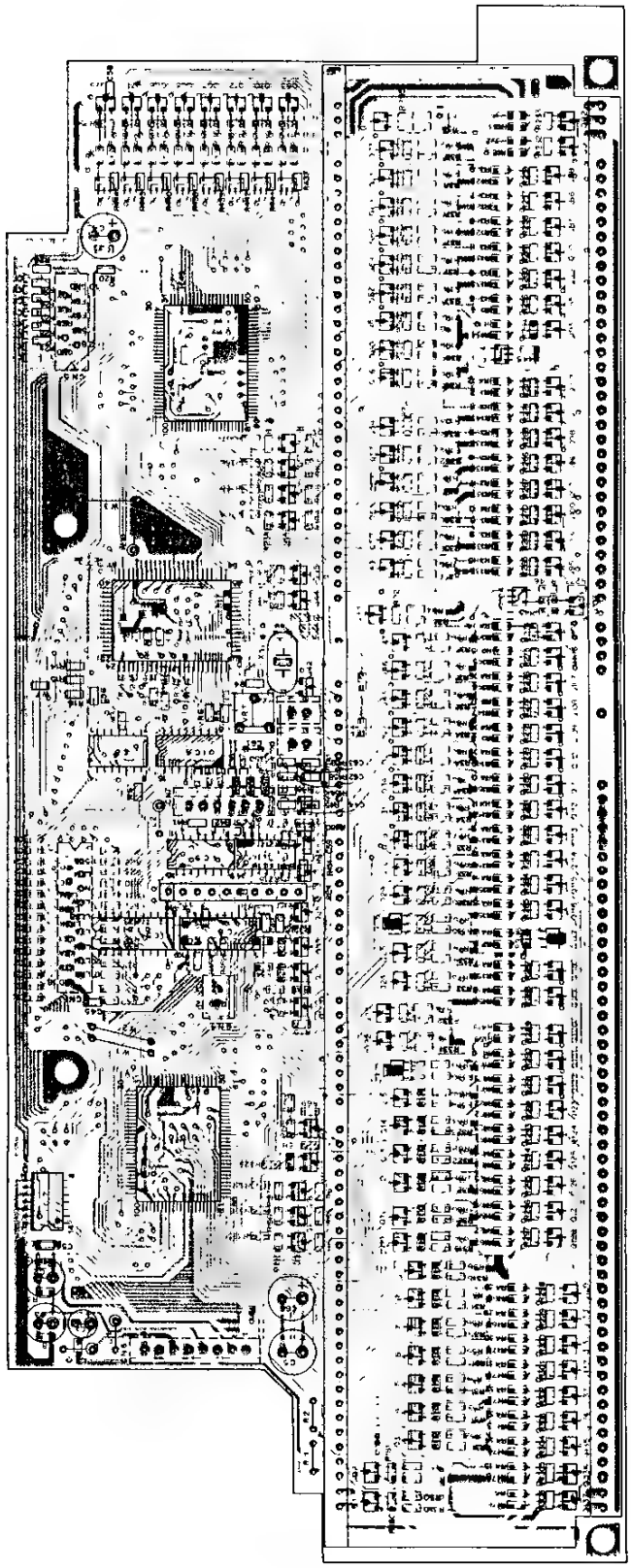


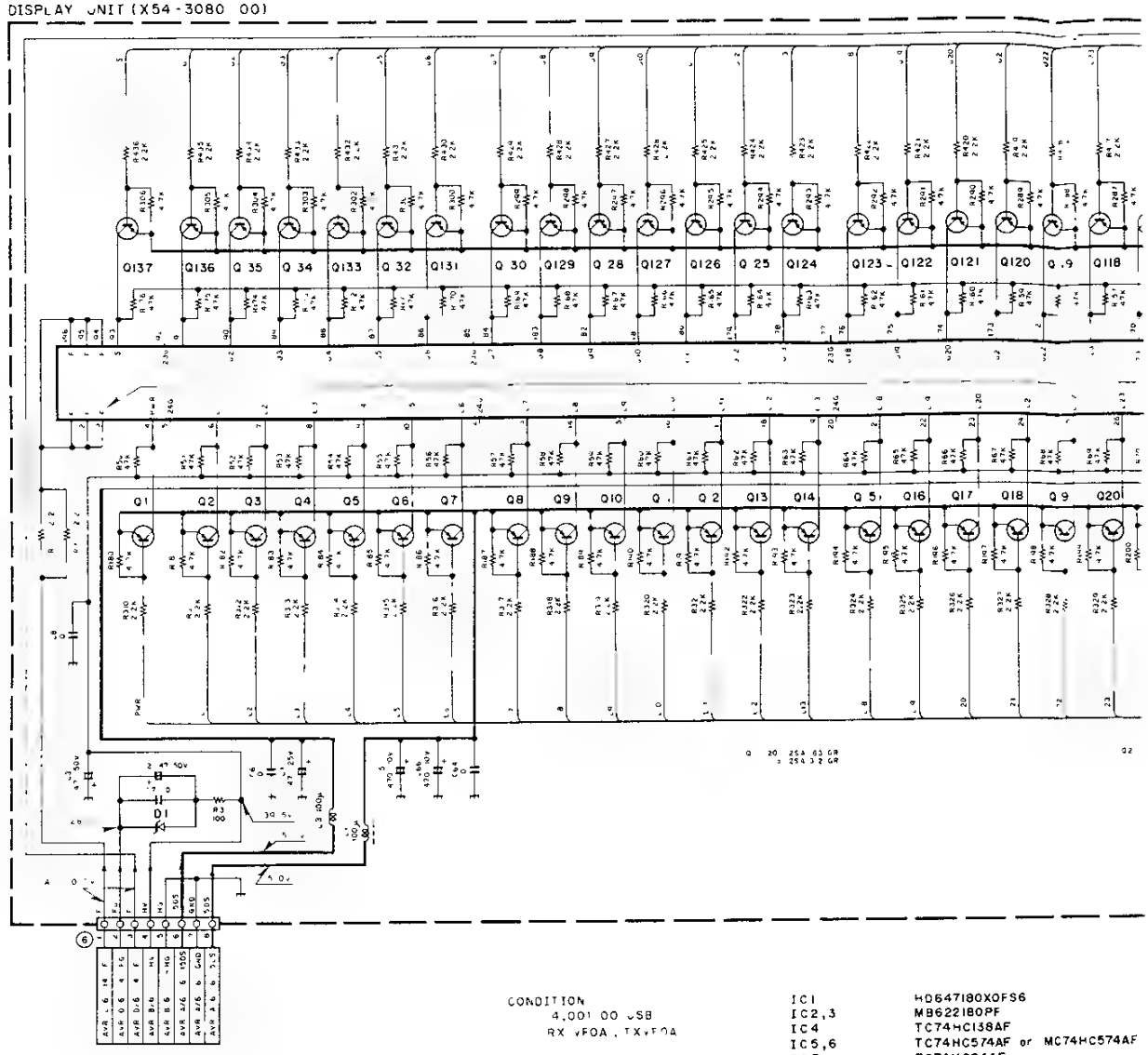
DISPLAY UNIT (X54-3080-00) Component side view



DISPLAY UNIT (X54-3080-00) Foil side view

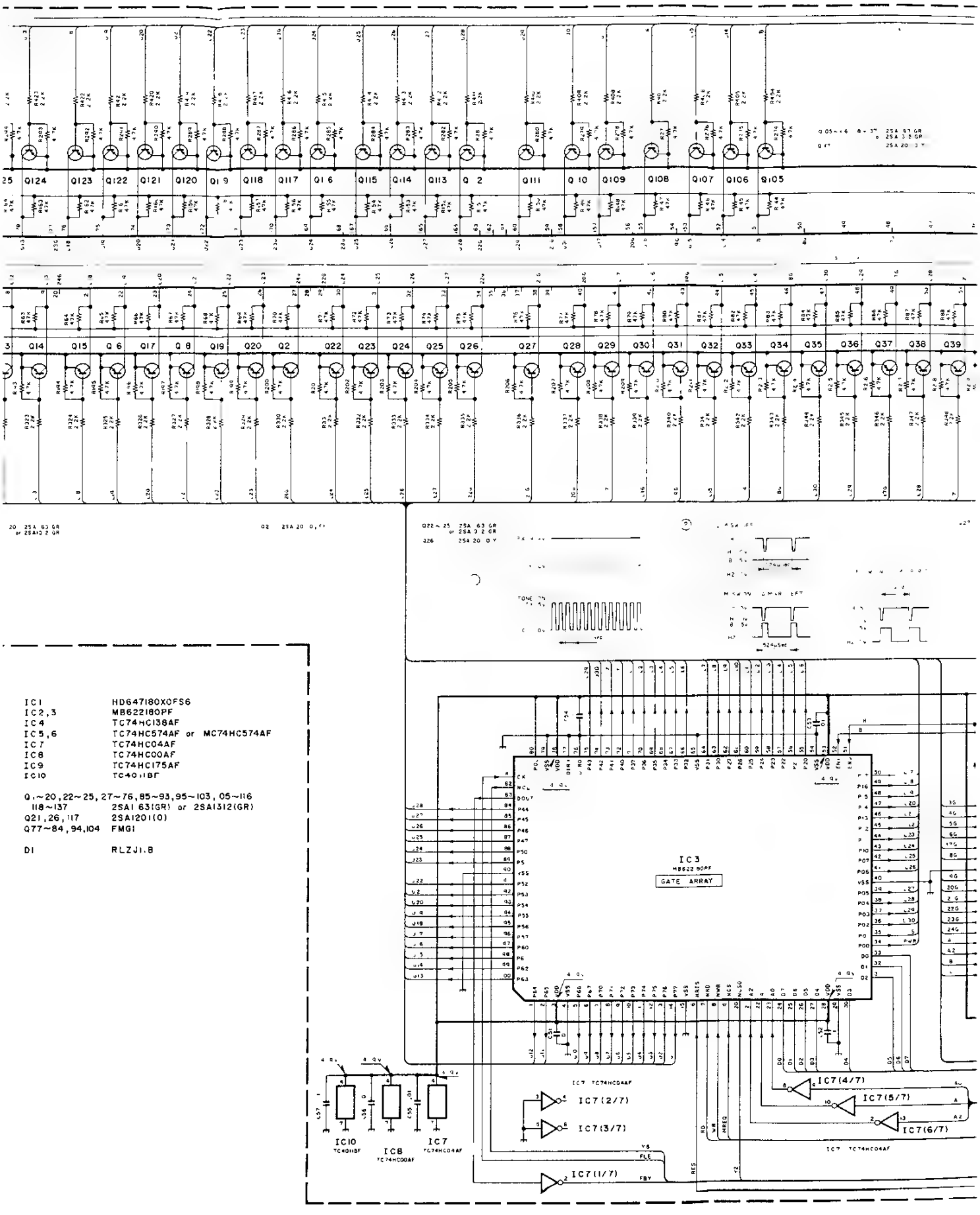
DISPLAY UNIT (X54-3080-00)

DISPLAY UNIT (X54-3080-00)

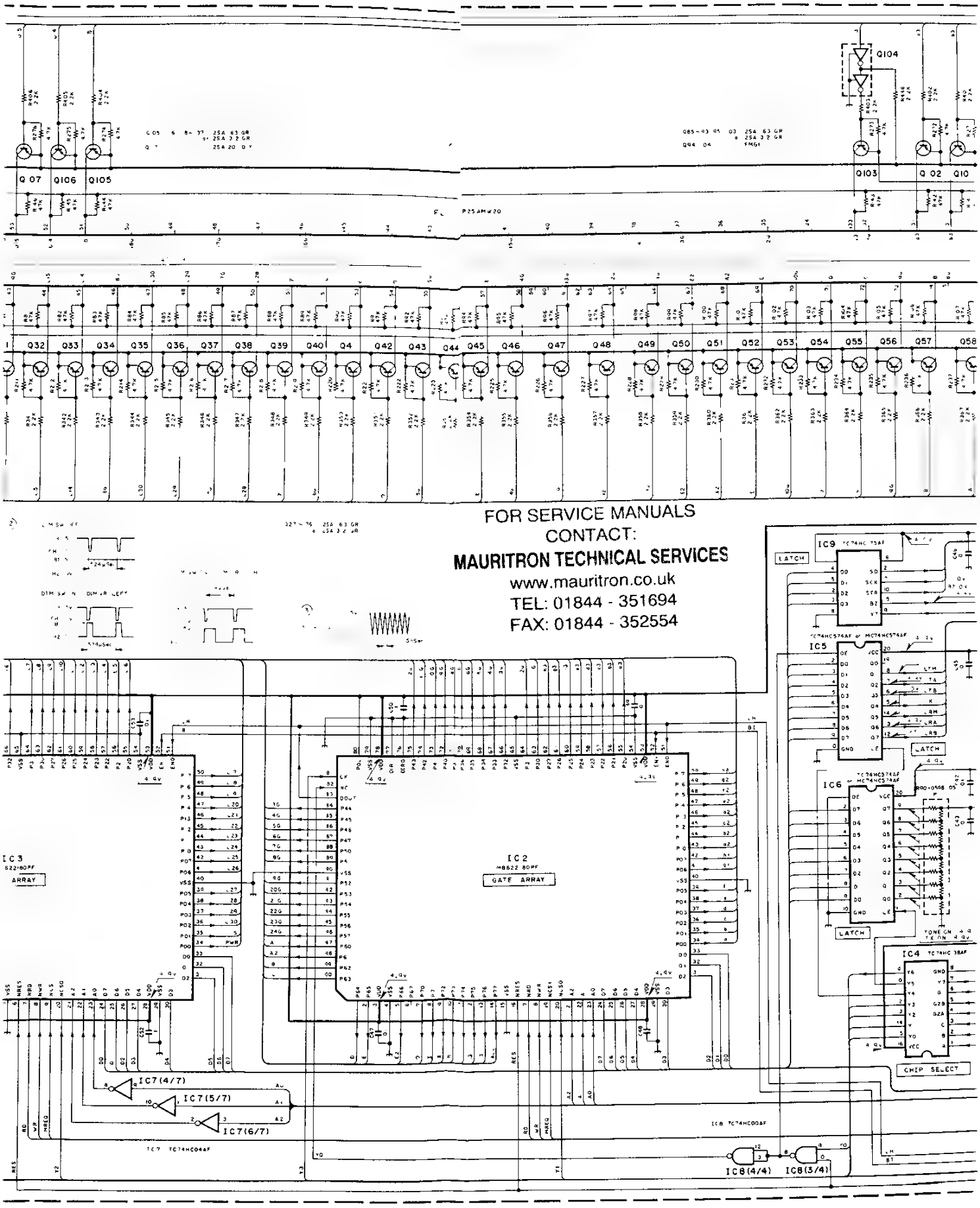


CONDITION
4.001 00 USB
RX VFOA , TX VFOA

IC1	HD647180X0FS6
IC2,3	MB622180PF
IC4	TC74HC138AF
IC5,6	TC74HC574AF or MC74HC574AF
IC7	TC74HC04AF
IC8	TC74HC00AF
IC9	TC74HC175AF
IC10	TC4011BF
Q1~20,22~25, 27~76,85~93,95~103,105~116 18~137	2SA1163(GR) or 2SA13 2(GR)
Q21,26,117	2SA1201(O)
Q77~84,94,04	FMG1
D1	RLZJ..B



IC1	HD647180X0FS6
IC2,3	MB622180PF
IC4	TC74HC138AF
IC5,6	TC74HC574AF or MC74HC574AF
IC7	TC74HC04AF
IC8	TC74HC00AF
IC9	TC74HC175AF
IC10	TC4011BF
Q1~20,22~25,27~76,85~93,95~103,105~116 118~137	2SA1 63(GR) or 2SA1312(GR)
Q21,26,117	2SA1201(O)
Q77~84,94,104	FMG1
D1	RLZJ1.8


Q104
Q103
Q 02
Q10
Q 07
Q106
Q105
Q32
Q33
Q34
Q35
Q36
Q37
Q38
Q39
Q40
Q4
Q42
Q43
Q44
Q45
Q46
Q47
Q48
Q49
Q50
Q51
Q52
Q53
Q54
Q55
Q56
Q57
Q58
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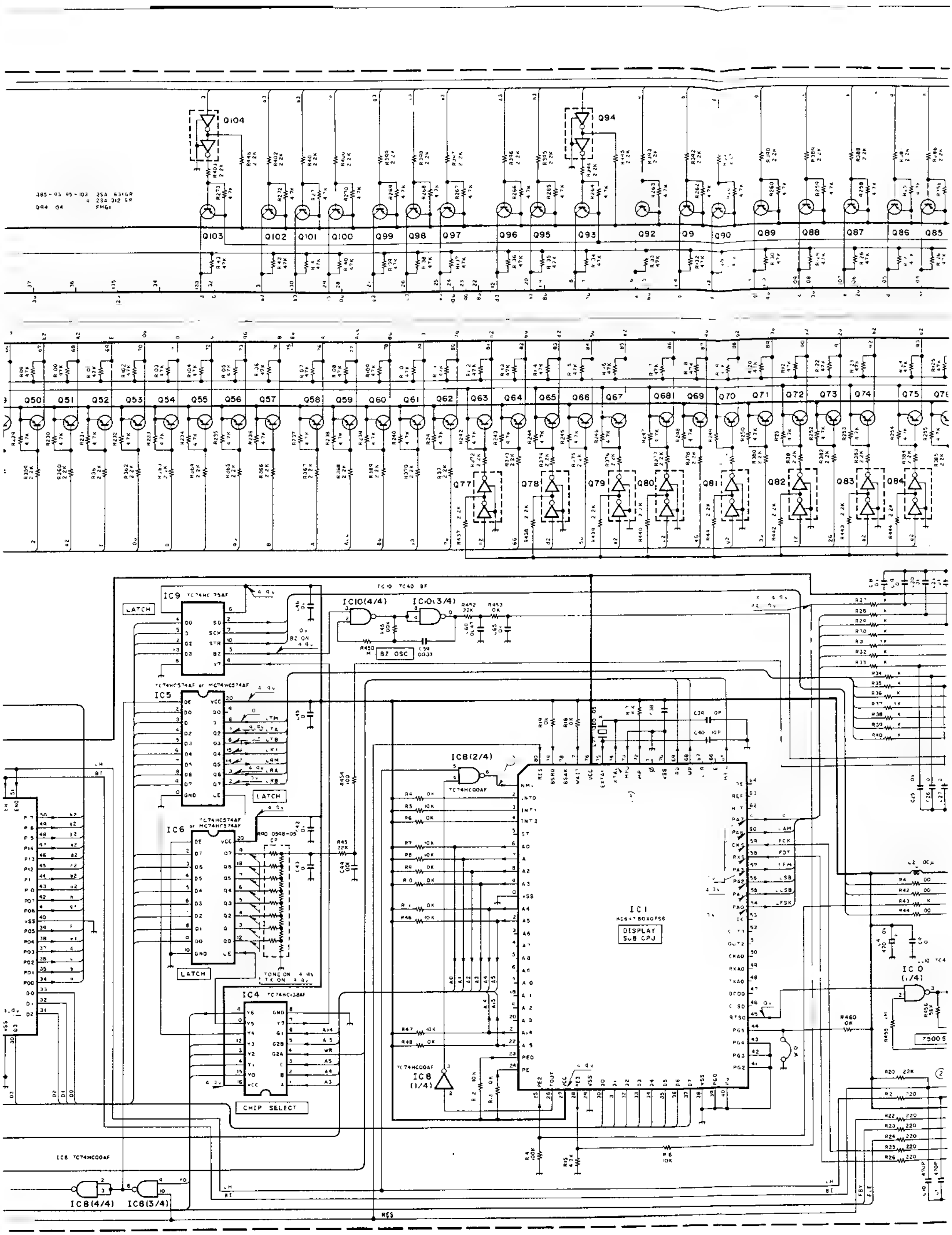
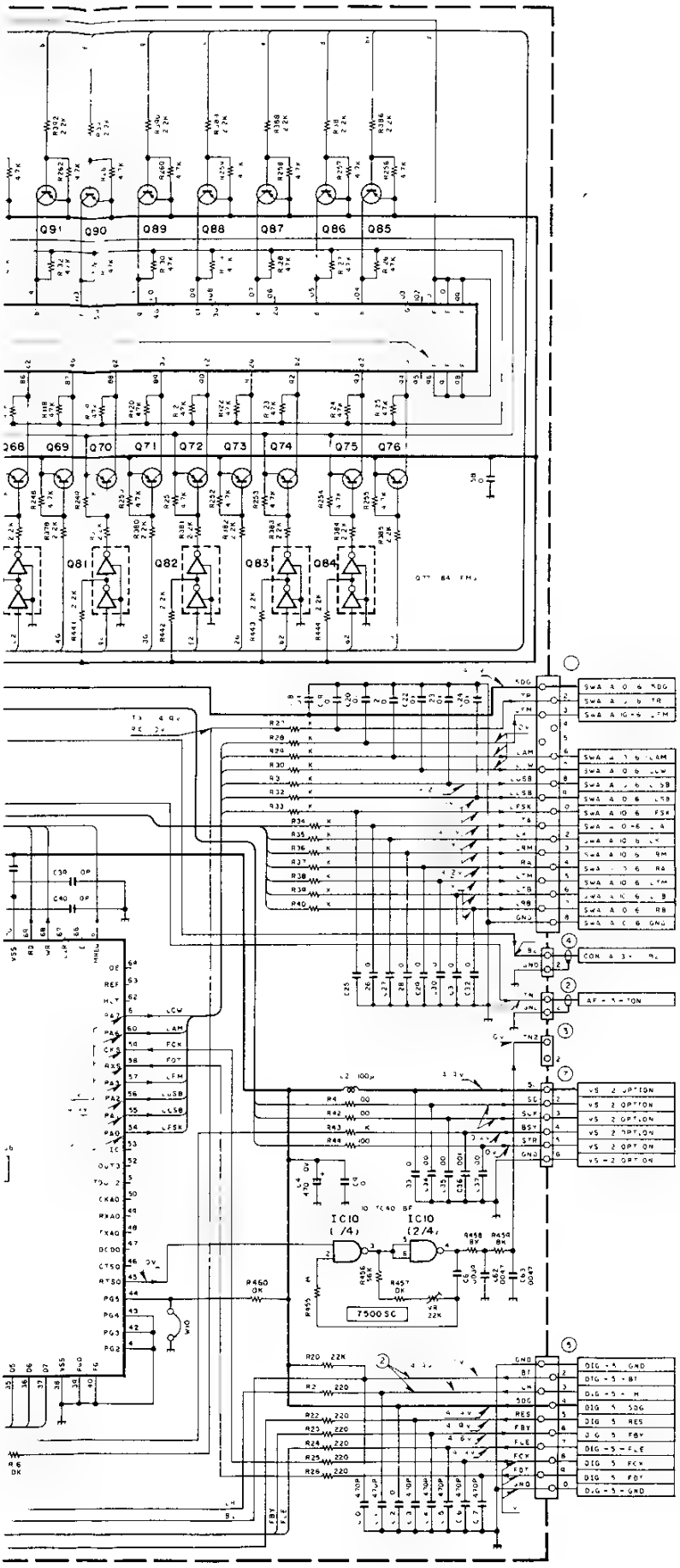
IC9
LATCH
IC5
LATCH
IC6
LATCH
IC4
CHIP SELECT
IC3
ARRAY
IC2
GATE ARRAY
IC7(4/7)
IC7(5/7)
IC7(6/7)
IC8(4/4)
IC8(3/4)

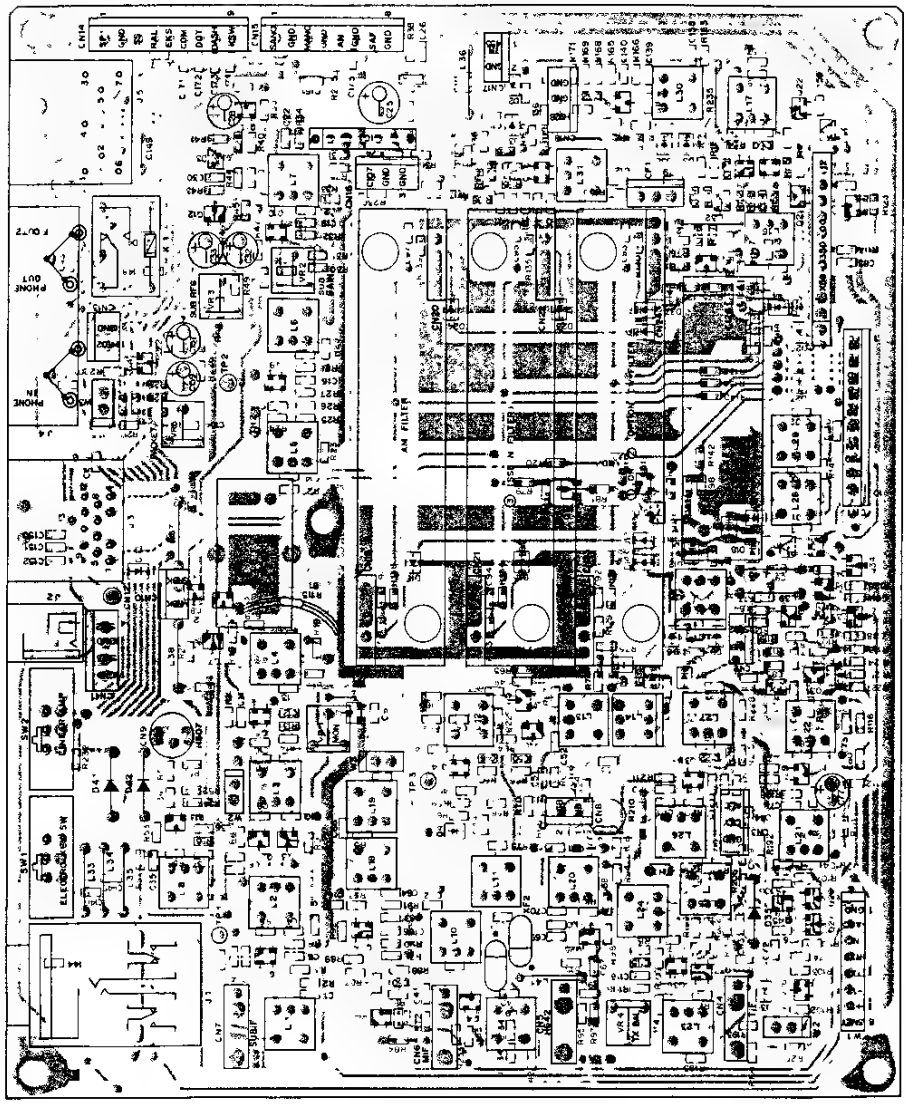


Q104
Q94
Q103
Q102
Q101
Q100
Q99
Q98
Q97
Q96
Q95
Q93
Q92
Q90
Q89
Q88
Q87
Q86
Q85
Q50
Q51
Q52
Q53
Q54
Q55
Q56
Q57
Q58
Q59
Q60
Q61
Q62
Q63
Q64
Q65
Q66
Q67
Q68
Q69
Q70
Q71
Q72
Q73
Q74
Q75
Q77
Q78
Q79
Q80
Q81
Q82
Q83
Q84
IC9
LATCH
IC10(4/4)
IC10(3/4)
BZ OSC
IC5
IC6
IC4
CHIP SELECT
IC8(2/4)
IC8 (1/4)
IC1
DISPLAY SUB CPU
IC8(4/4)
IC8(3/4)
RES

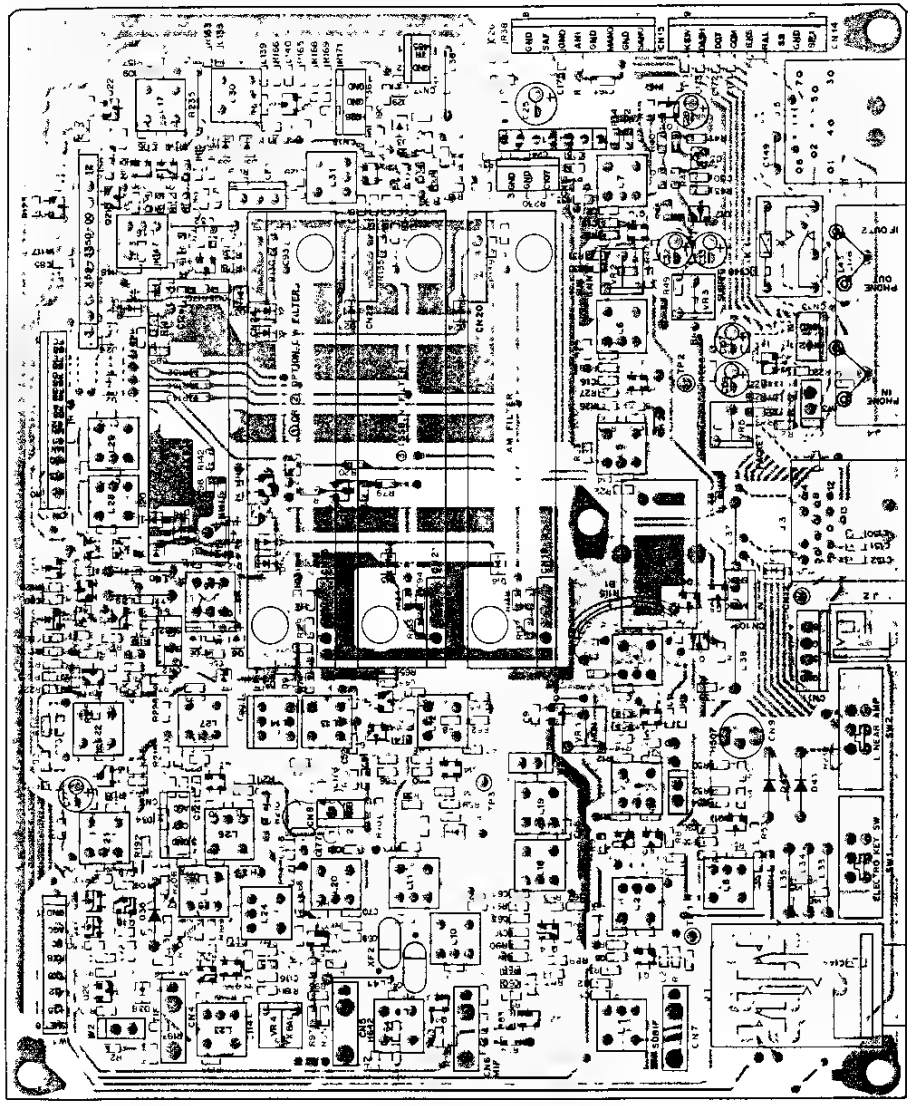


TS-950S/SD PC BOARD VIEWS

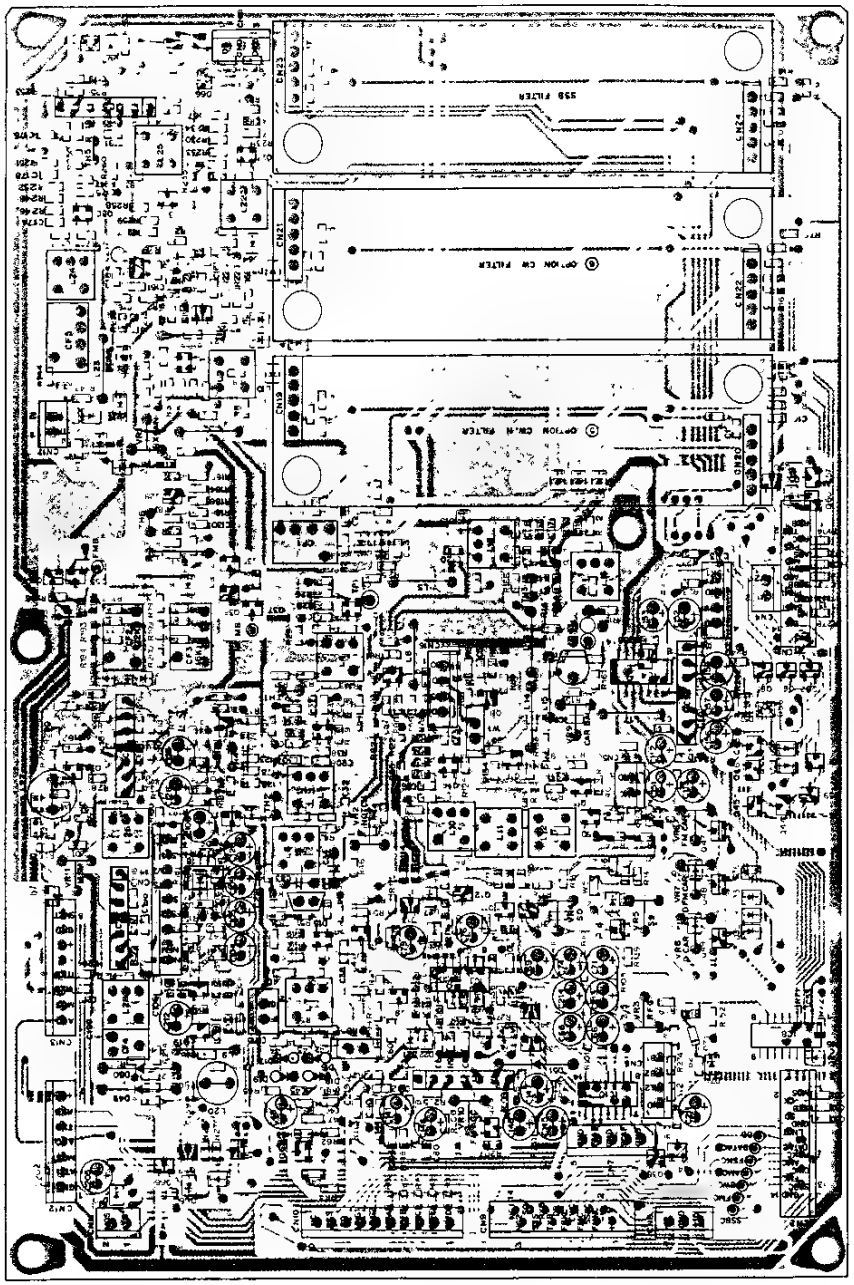
IF UNIT (X48-3060-00) Component side view



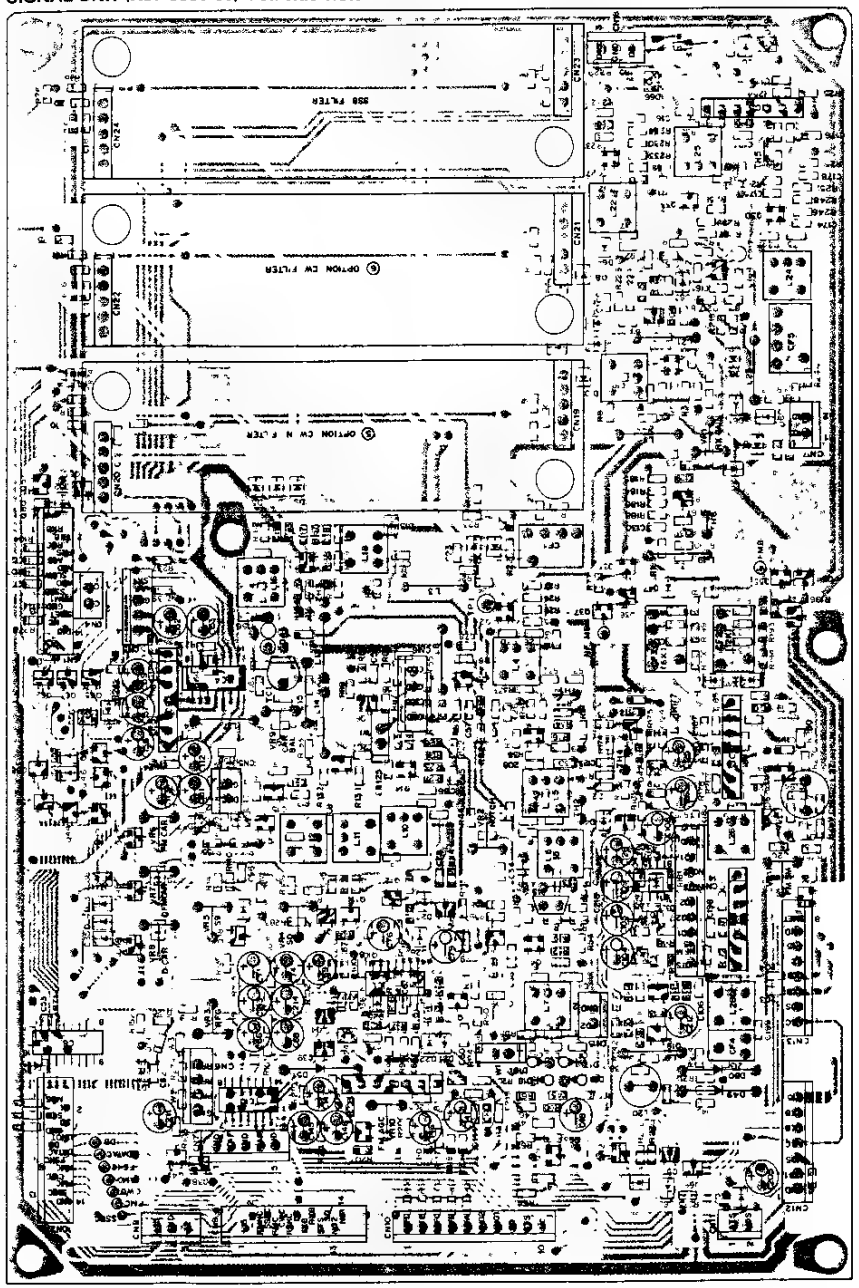
IF UNIT (X48-3060-00) Foil side view



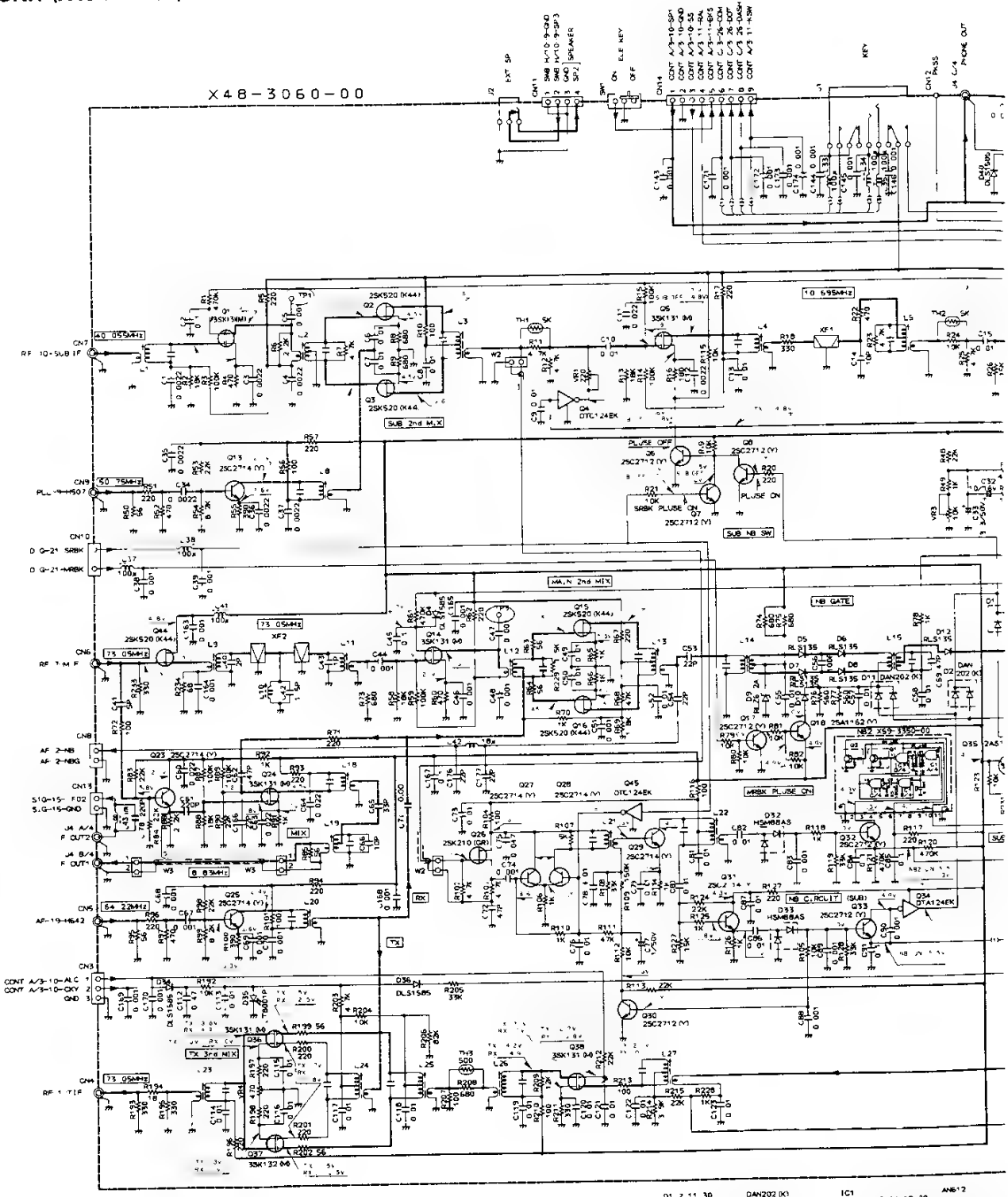
SIGNAL UNIT (X57-3380-00) Component side view

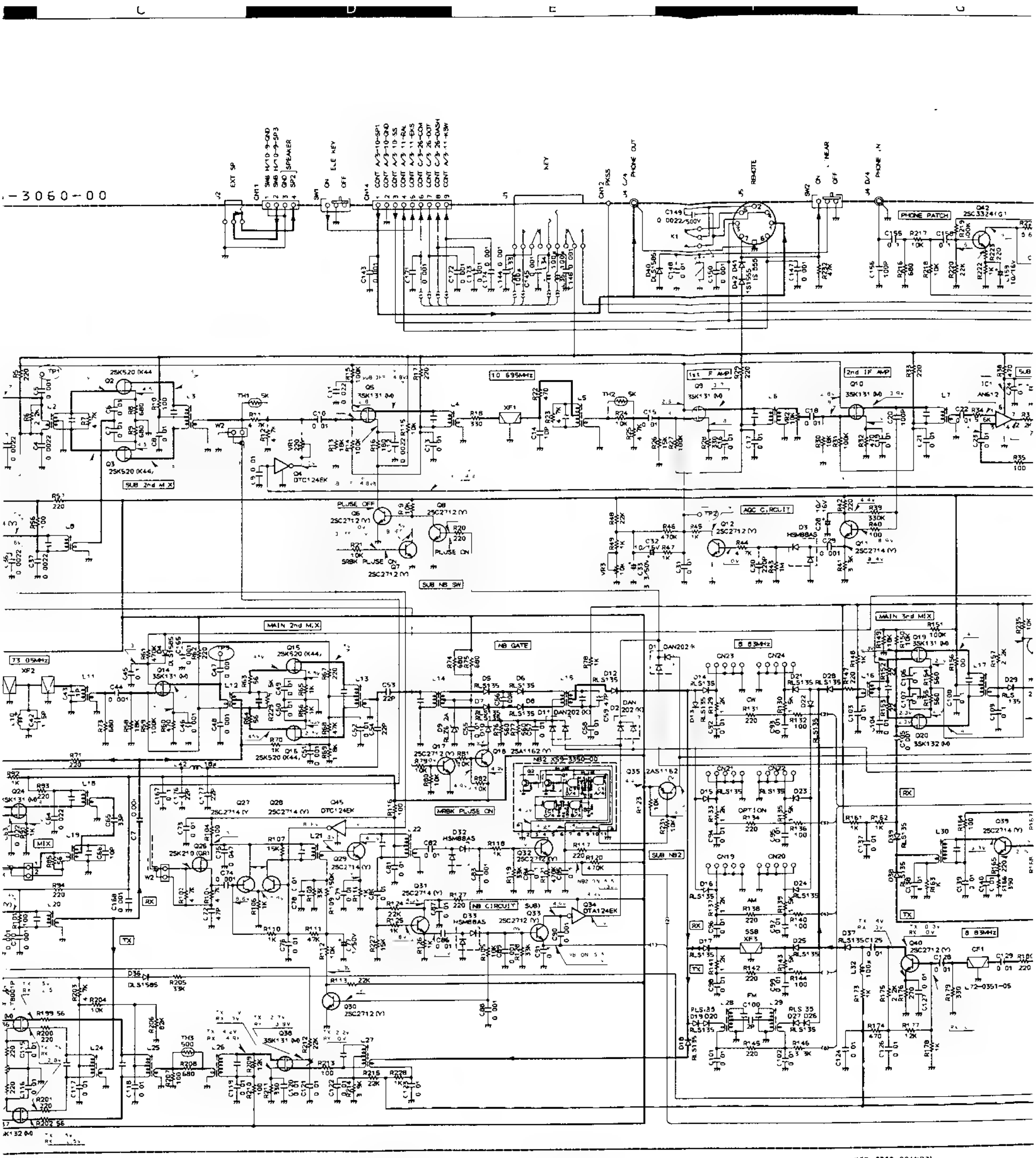


SIGNAL UNIT (X57-3380-00) Foil side view

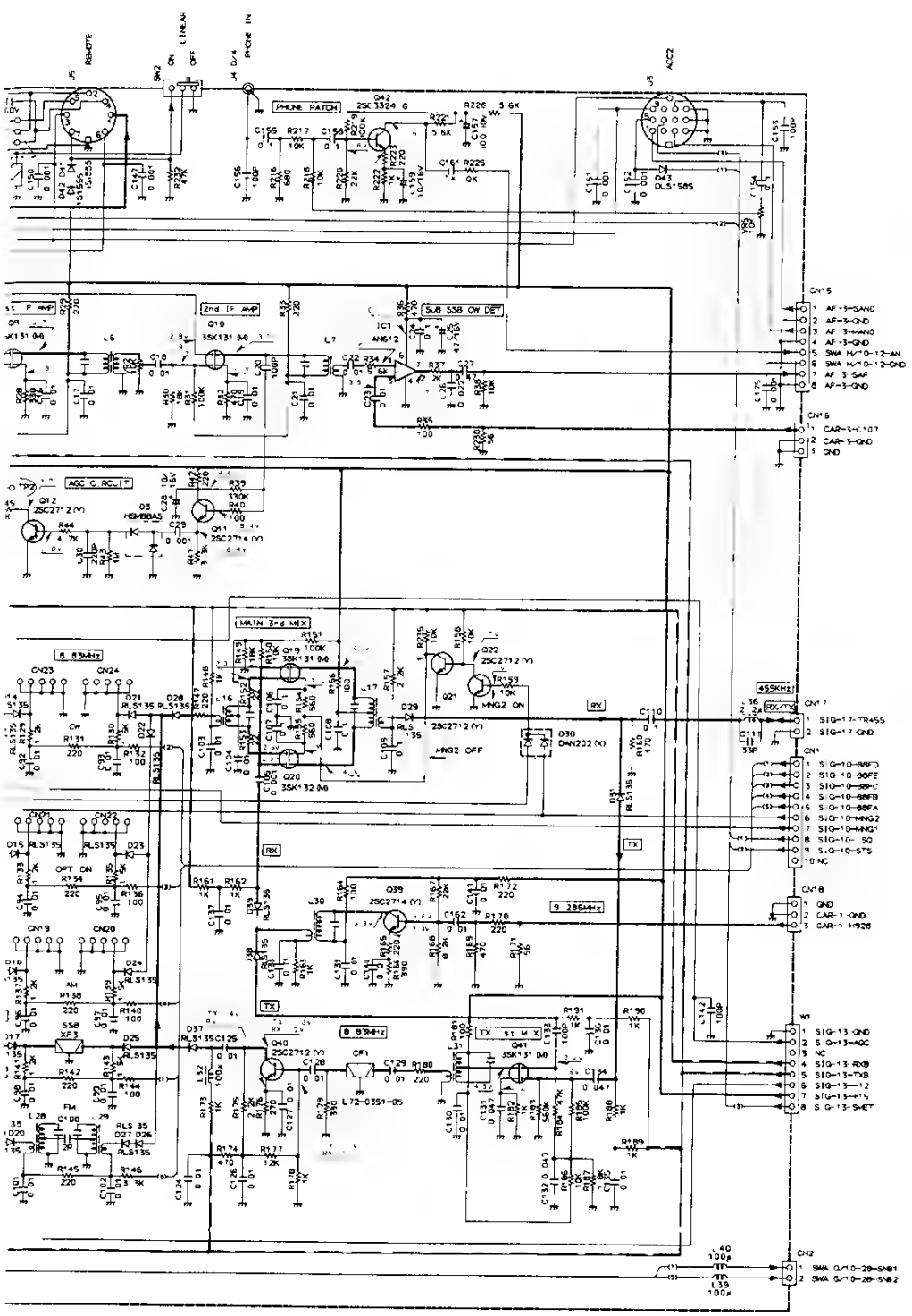


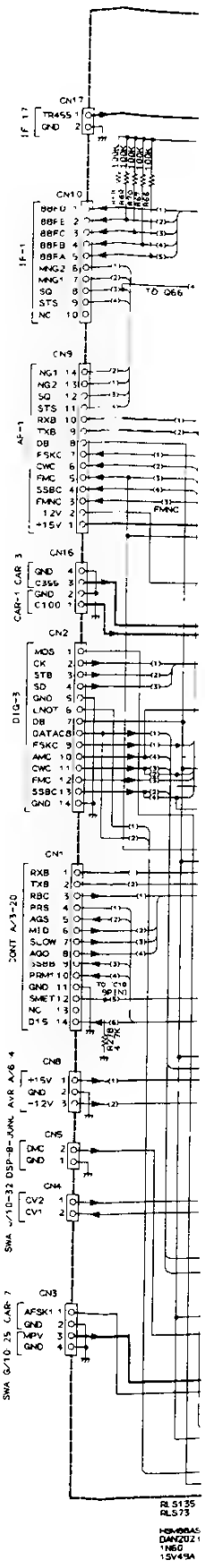
IF UNIT (X48-3060-00)



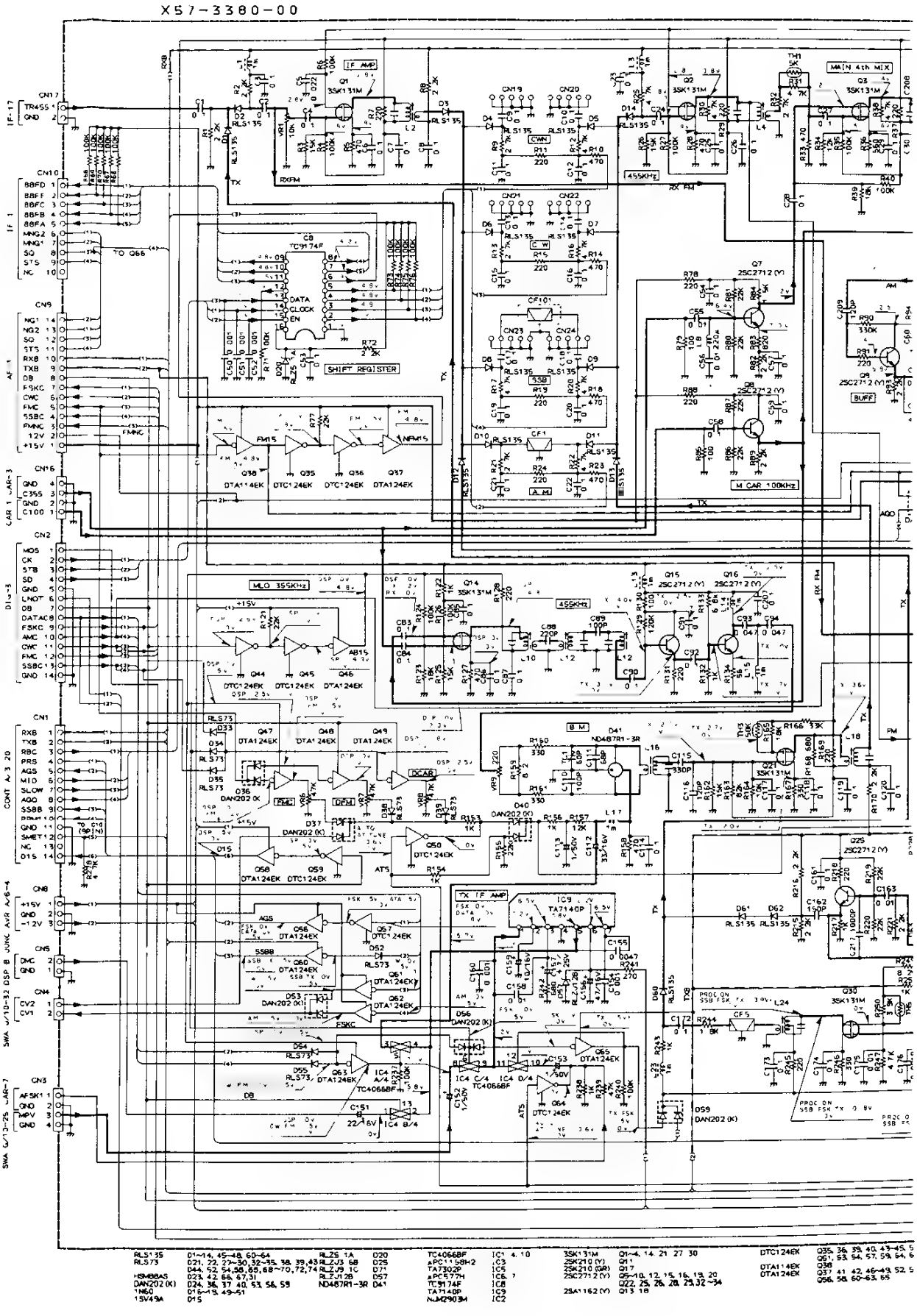

-3060-00
EXT SP
SPEAKER
ELE KEY
KEY
PHONE OUT
REMOTE
NEAR
PHONE IN
PHONE PATCH
10.695MHz
1st IF AMP
2nd IF AMP
SUB 2nd MIX
PLUSE OFF
PLUSE ON
SRBK PLUSE ON
SUB NB SW
AGC CIRCUIT
MAIN 2nd MIX
73.05MHz
NB GATE
8.83MHz
MAIN 3rd MIX
NB2 X59-3350-00
MRBK PLUSE ON
NB CIRCUIT
SUB NB2
OPTION
MIX
RX
TX
CW
AM
SSB
FM
L72-0351-05
D1, 2, 11, 30 DAN202 (K)
D3, 32, 33 HSM88AS
D4, 34, 36, 40, 43 DLS1585
D5, 6, 10, 12~29, 31, 37~39 RLS135
D9 RLZ6.2A
D35 LTB001P
D41, 42 1S1555
IC1 AN612
Q1, 5, 9, 10, 14, 19, 20, 24, 36, 37, 38, 41 3SK131 (M)
Q2, 3, 15, 16, 44 2SK520 (K44)
Q4, 45 DTC124EK
Q6, 7, 8, 12, 17, 21, 22, 30, 32, 33, 40 2SC2712 (Y)
Q42 2SC3324 (G)
Q11, 13, 23, 25, 27, 28, 29, 31, 39 2SC2714 (Y)
Q18, 35 2SA1162 (Y)
Q26 2SK210 (GR)
Q34 DTA124EK
Q42 2SC3324 (G)
X59-3350-00 (NB2)
IC TC4OF
Q1, 2 DTC124EK

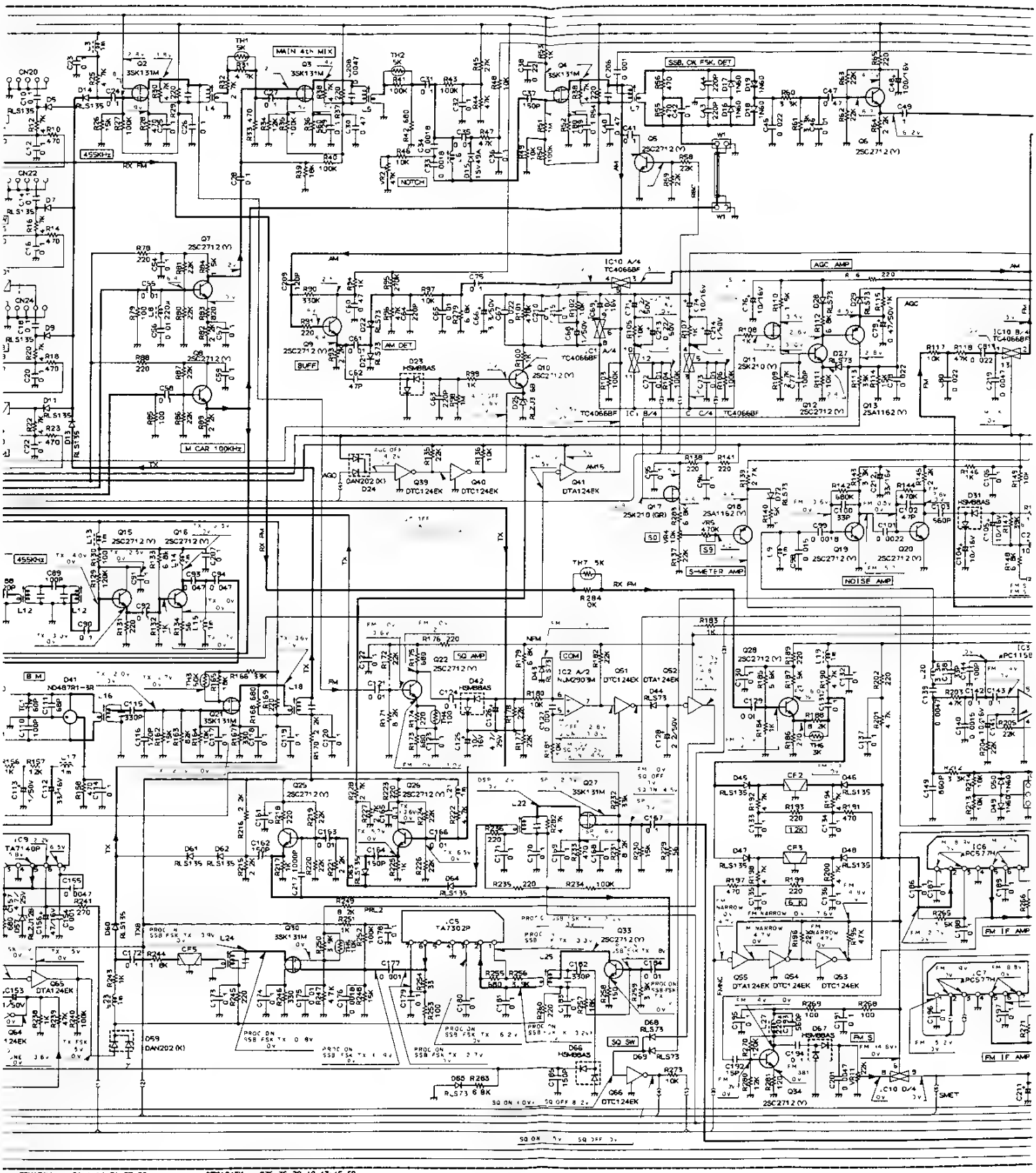
SIGNAL UNIT (X





SIGNAL UNIT (X57-3380-00)

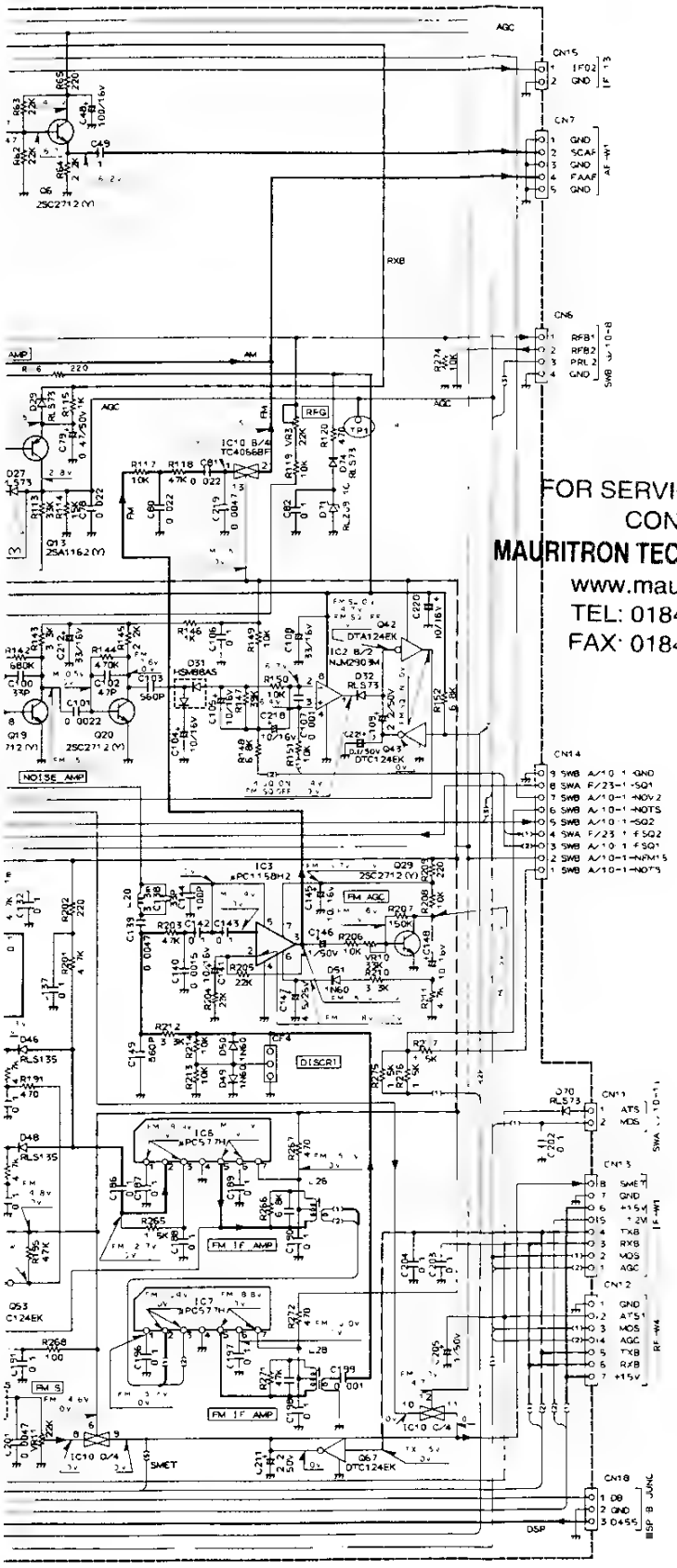




3SK131M Q1~4, 14, 21, 27, 30
2SK210 (Y) Q11
2SK210 (GR) Q17
2SC2712 (Y) Q5~10, 12, 15, 16, 19, 20, 22, 25, 26, 28, 29, 32~34
2SA1162 (Y) Q13, 18

DTC124EK Q35, 36, 39, 40, 43~45, 50, Q61, 53, 54, 57, 59, 64, 66, 67
DTA114EK Q38
DTA124EK Q37, 41, 42, 46~49, 52, 55, Q56, 58, 60~63, 65

CIRCUIT DIAGRAMS TS-950S/SD



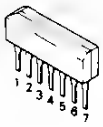
2SA1162
2SC2712
2SC2714
2SC3324
DTA114EK
DTA124EK
DTA124EK
DTA124EK
DTC124EK

2SK520

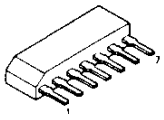
2SK210

3SK131

TA7140P
TA7302P
μPC1158H2

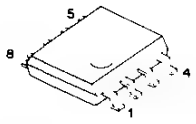


AN612

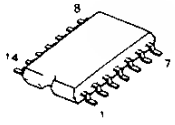


μPC577H

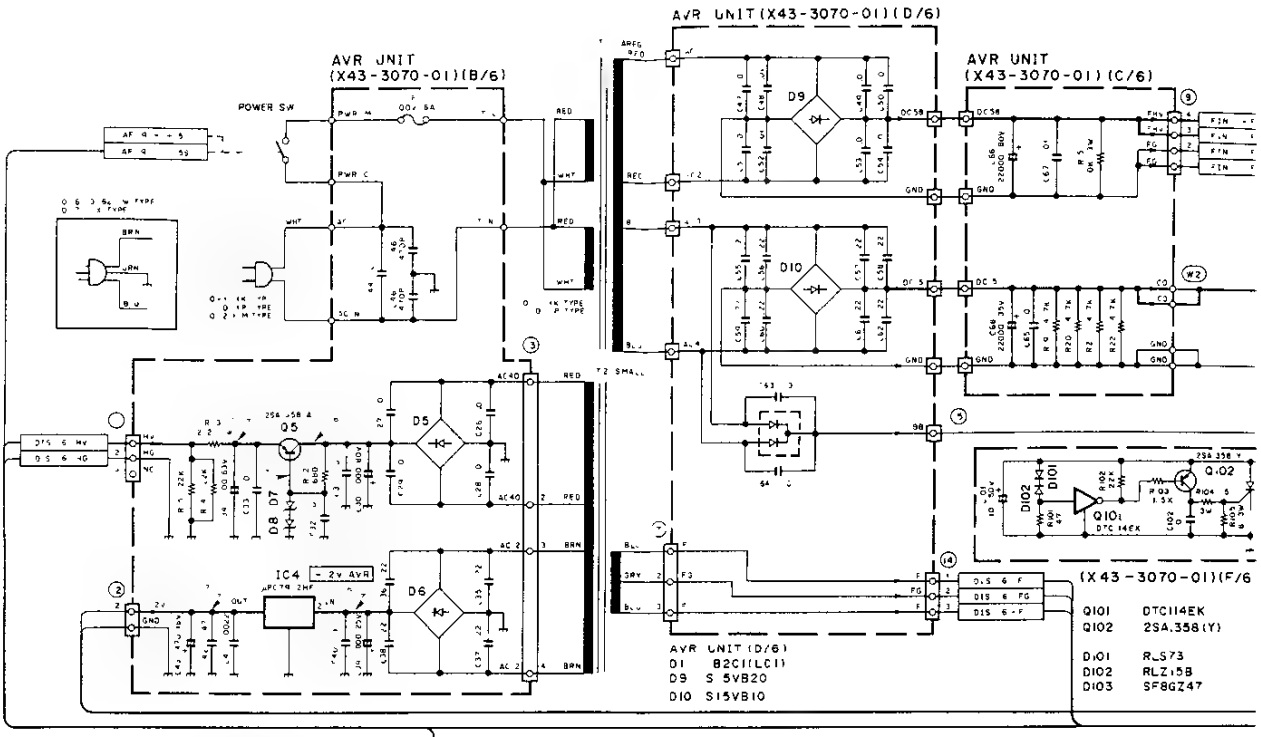
NJM2903M



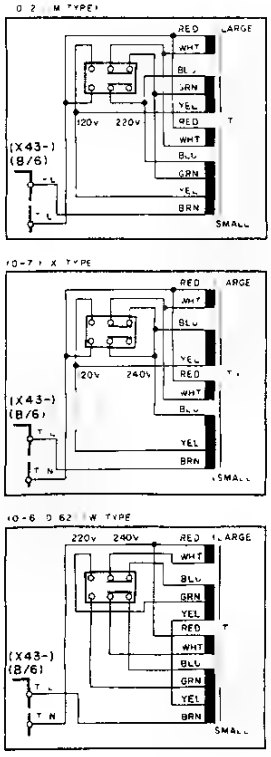
TC4066BF

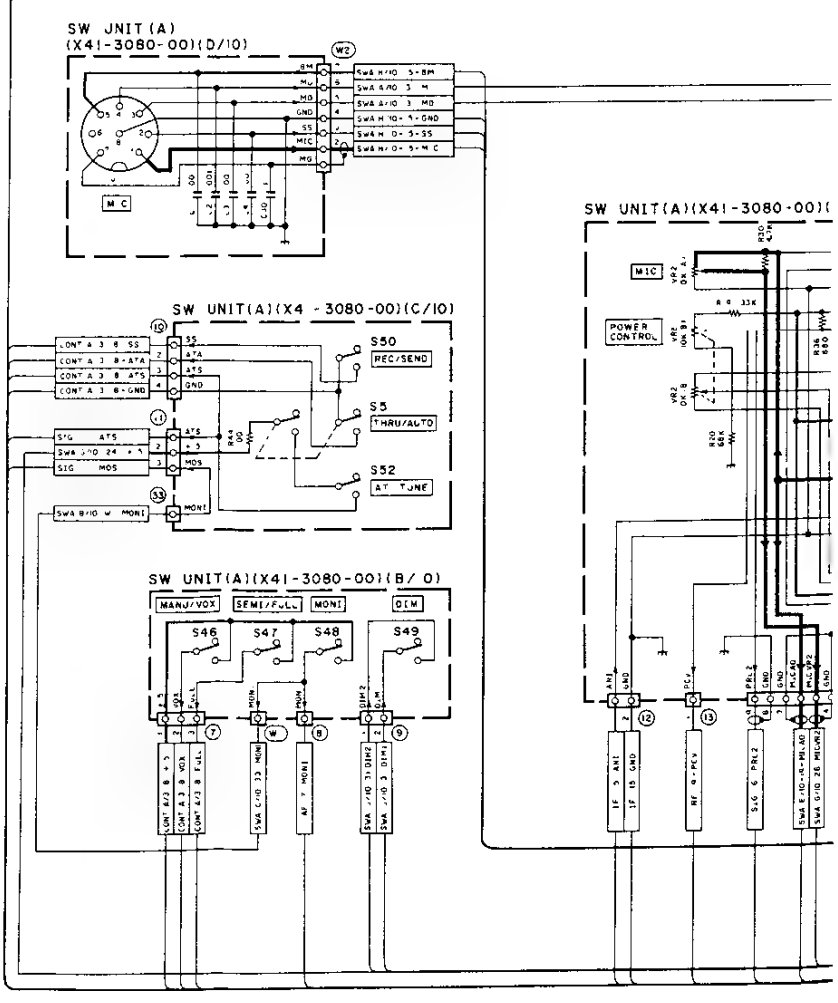


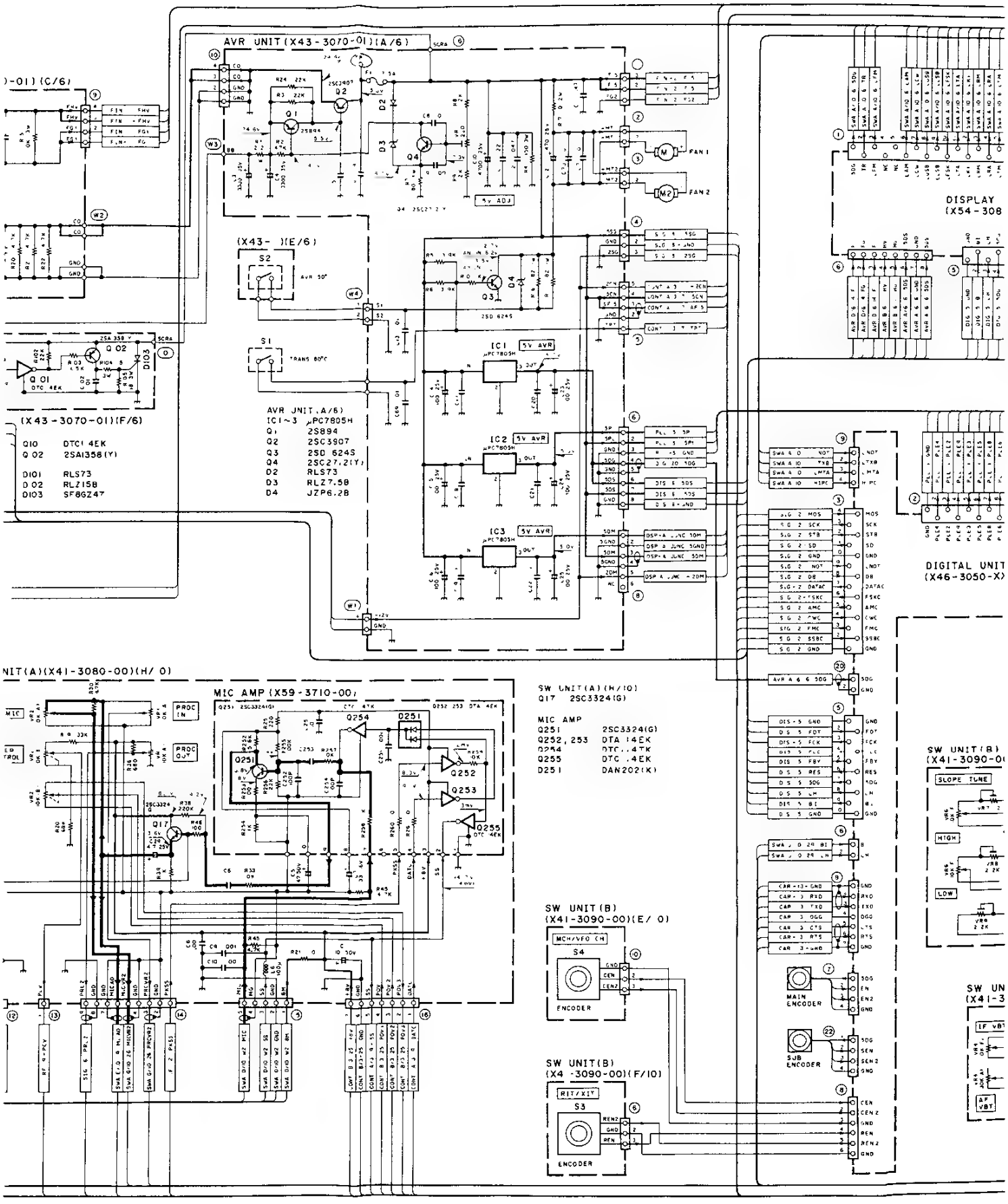
TS-950S/SD SCHEMATIC DIAGRAM

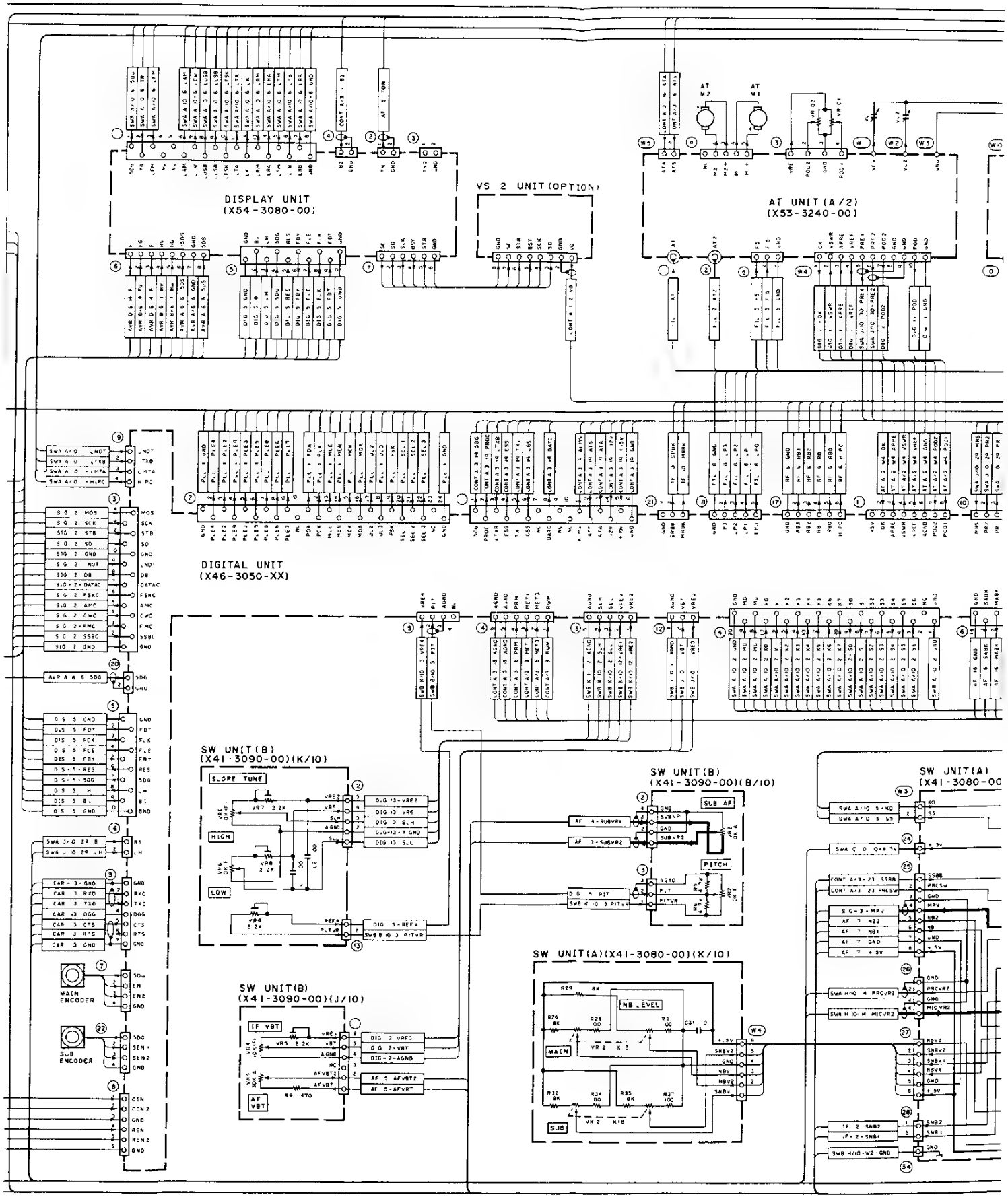


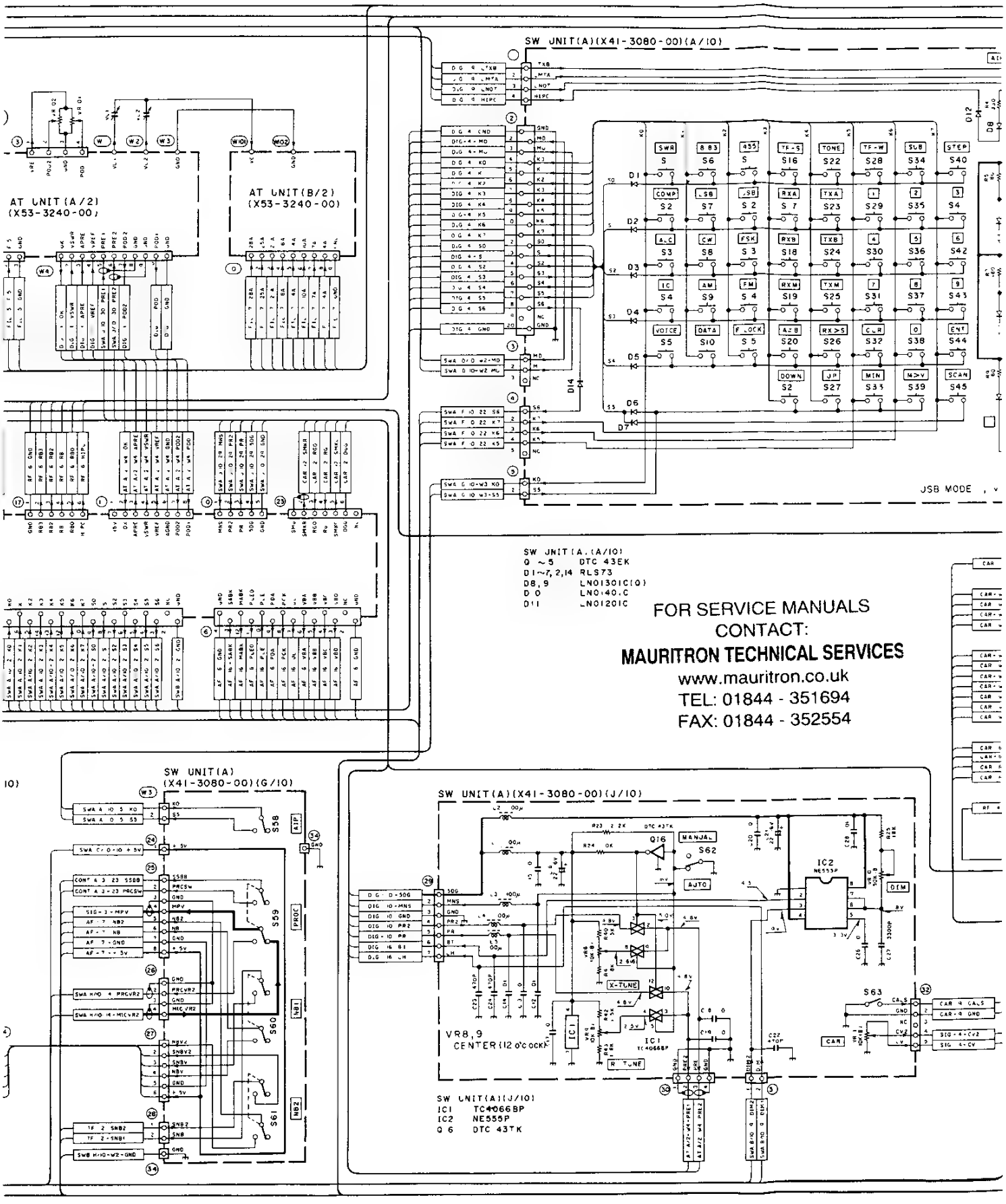
AVR UNIT (B/6)
IC4 μPC79 2HF
Q5 2SA1358(A
D5,6 S1WB.0
D7,8 RLZ20C






AVR UNIT (X43-3070-01) (A/6)
(X43-3070-01) (F/6)
Q10 DTC1 4EK
Q02 2SA1358(Y)
D101 RLS73
D02 RLZ15B
D103 SF86Z47
AVR UNIT (A/6)
IC1~3 μPC7805H
Q1 2S894
Q2 2SC3907
Q3 2SD 624S
Q4 2SC27.2(Y)
D2 RLS73
D3 RLZ7.5B
D4 JZP6.2B
IC1 5V AVR
IC2 5V AVR
IC3 5V AVR
FAN 1
FAN 2
DISPLAY (X54-308
DIGITAL UNIT (X46-3050-X)
MIC AMP (X59-3710-00)
SW UNIT (A) (H/10)
Q17 2SC3324(G)
MIC AMP
Q251 2SC3324(G)
Q252, 253 DTA 14EK
Q254 DTC..4TK
Q255 DTC .4EK
D251 DAN202(K)
SW UNIT (B) (X41-3090-00) (E/ 0)
SW UNIT (B) (X41-3090-00) (F/10)
MAIN ENCODER
SUB ENCODER
SLOPE TUNE
HIGH
LOW


DISPLAY UNIT
(X54-3080-00)
VS 2 UNIT(OPTION)
AT UNIT(A/2)
(X53-3240-00)
DIGITAL UNIT
(X46-3050-XX)
SW UNIT(B)
(X41-3090-00)(K/10)
SW UNIT(B)
(X41-3090-00)(B/10)
SW UNIT(A)
(X41-3080-00)
SW UNIT(B)
(X41-3090-00)(J/10)
SW UNIT(A)(X41-3080-00)(K/10)
MAIN ENCODER
SUB ENCODER


SW UNIT(A)(X41-3080-00)(A/10)
AT UNIT(A/2)
(X53-3240-00)
AT UNIT(B/2)
(X53-3240-00)
SW UNIT(A)
(X41-3080-00)(G/10)
SW UNIT(A)(X41-3080-00)(J/10)
SW UNIT(A).(A/10)
Q ~5 DTC 43EK
D1~7, 2, 14 RLS73
D8, 9 LN01301C(O)
D 0 LN0140.C
D11 LN01201C
SW UNIT(A)(J/10)
IC1 TC4066BP
IC2 NE555P
Q 6 DTC 43TK
VR8, 9
CENTER(12 o'clock)
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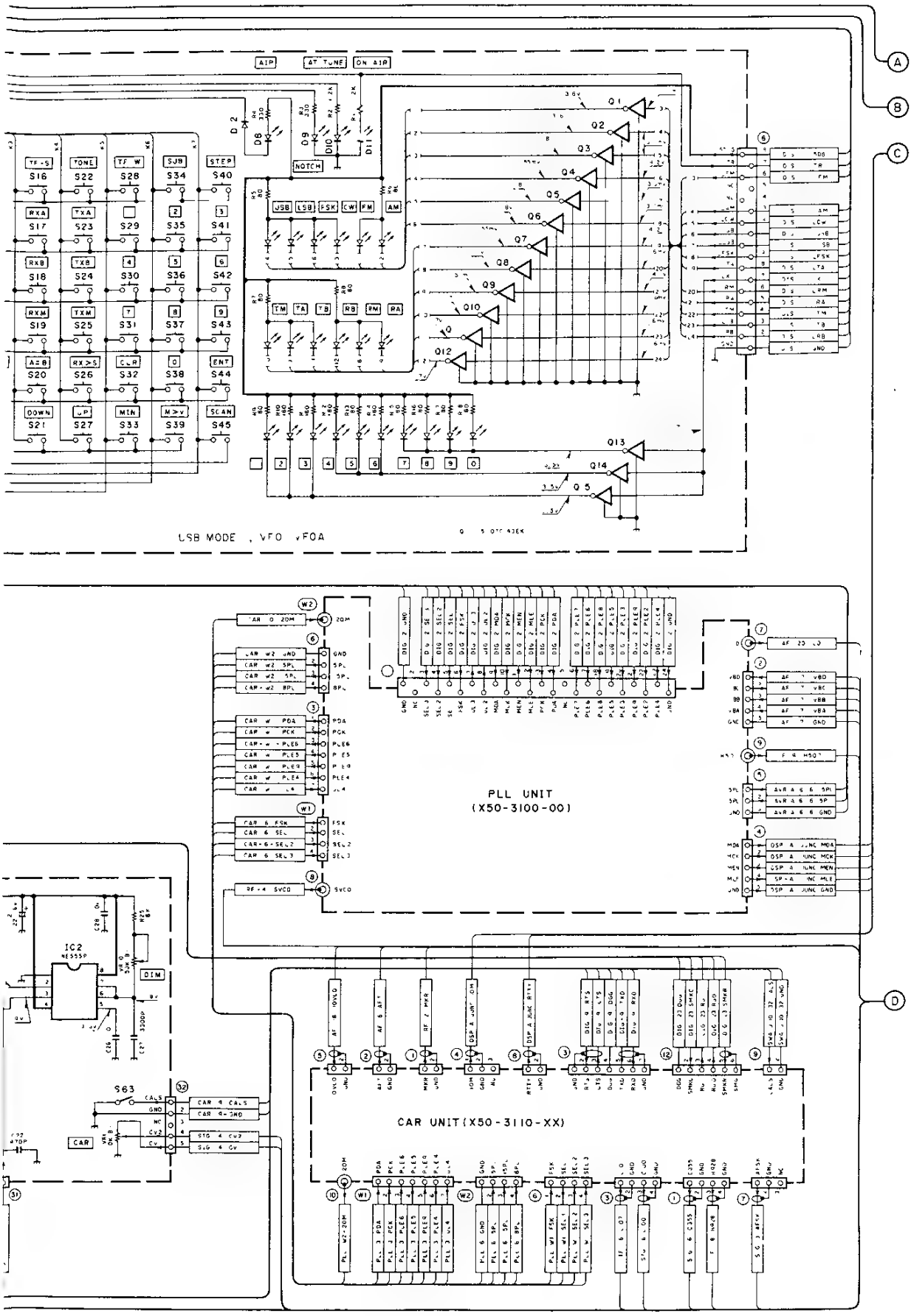
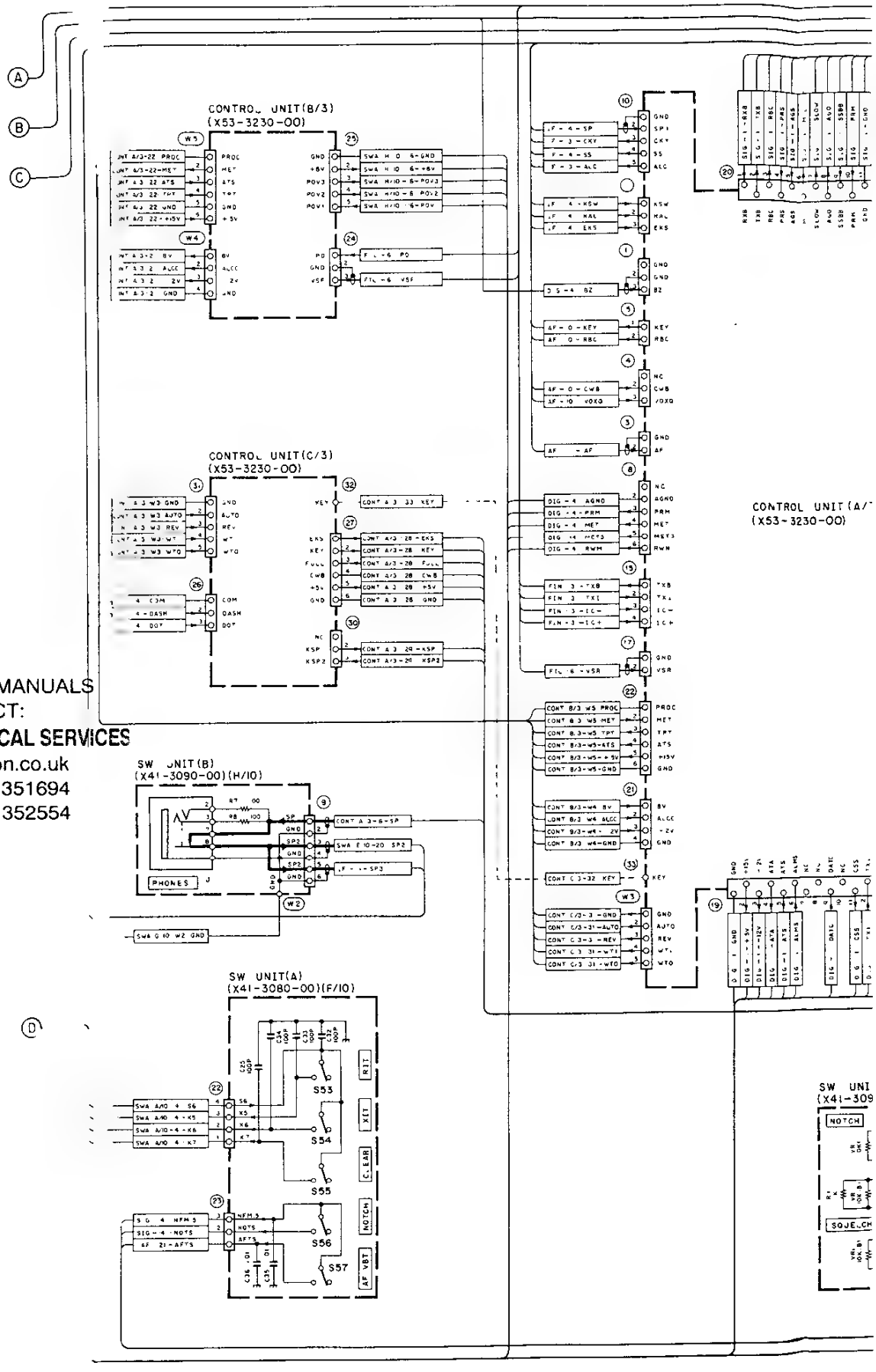
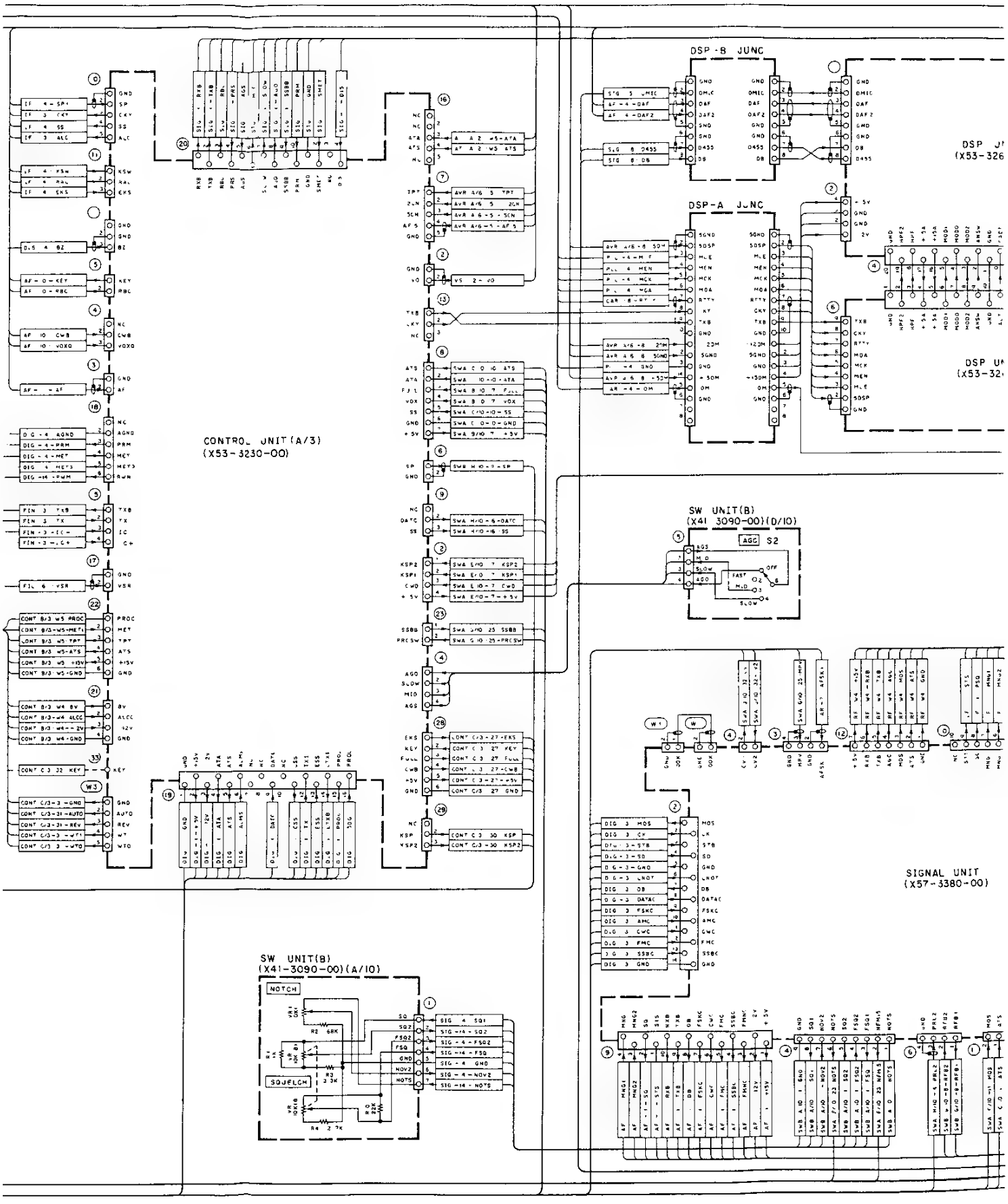
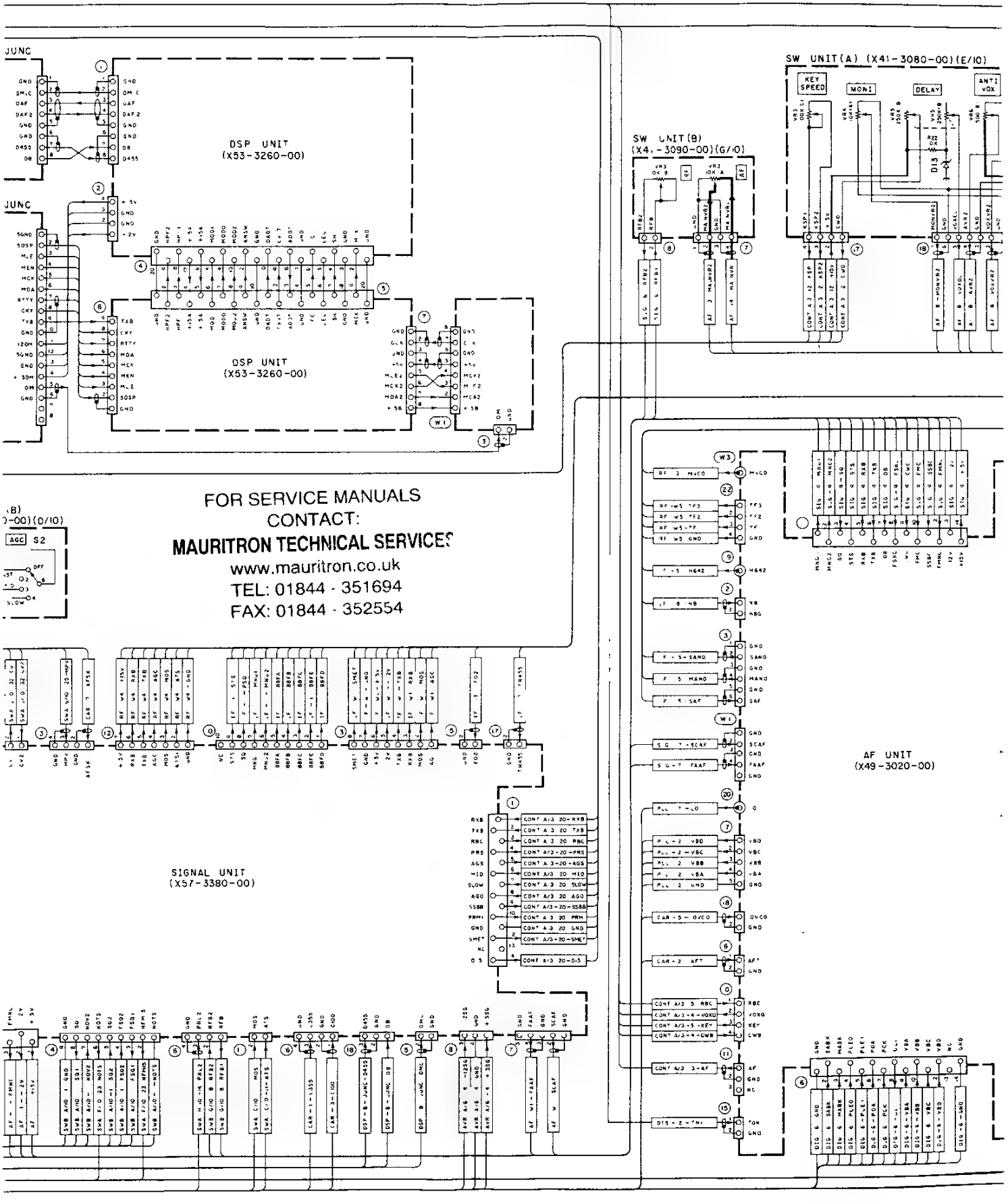
www.mauritron.co.uk
TEL: 01844 - 351694
FAX: 01844 - 352554


AIP
AT TUNE
ON AIR
NOTCH
USB
LSB
FSK
CW
FM
AM
TM
TA
TB
RB
RM
RA
S16
S22
S28
S34
S40
S17
S23
S29
S35
S41
S18
S24
S30
S36
S42
S19
S25
S31
S37
S43
S20
S26
S32
S38
S44
S21
S27
S33
S39
S45
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
LSB MODE , VFO , FOA
PLL UNIT
(X50-3100-00)
IC2
NE555P
DIM
S63
CAR
CAR UNIT(X50-3110-XX)
A
B
C
D




DSP-B JUNC
DSP-A JUNC
CONTROL UNIT(A/3)
(X53-3230-00)
SW UNIT(B)
(X41 3090-00)(D/10)
AGC S2
SW UNIT(B)
(X41-3090-00)(A/10)
NOTCH
SQUELCH
SIGNAL UNIT
(X57-3380-00)



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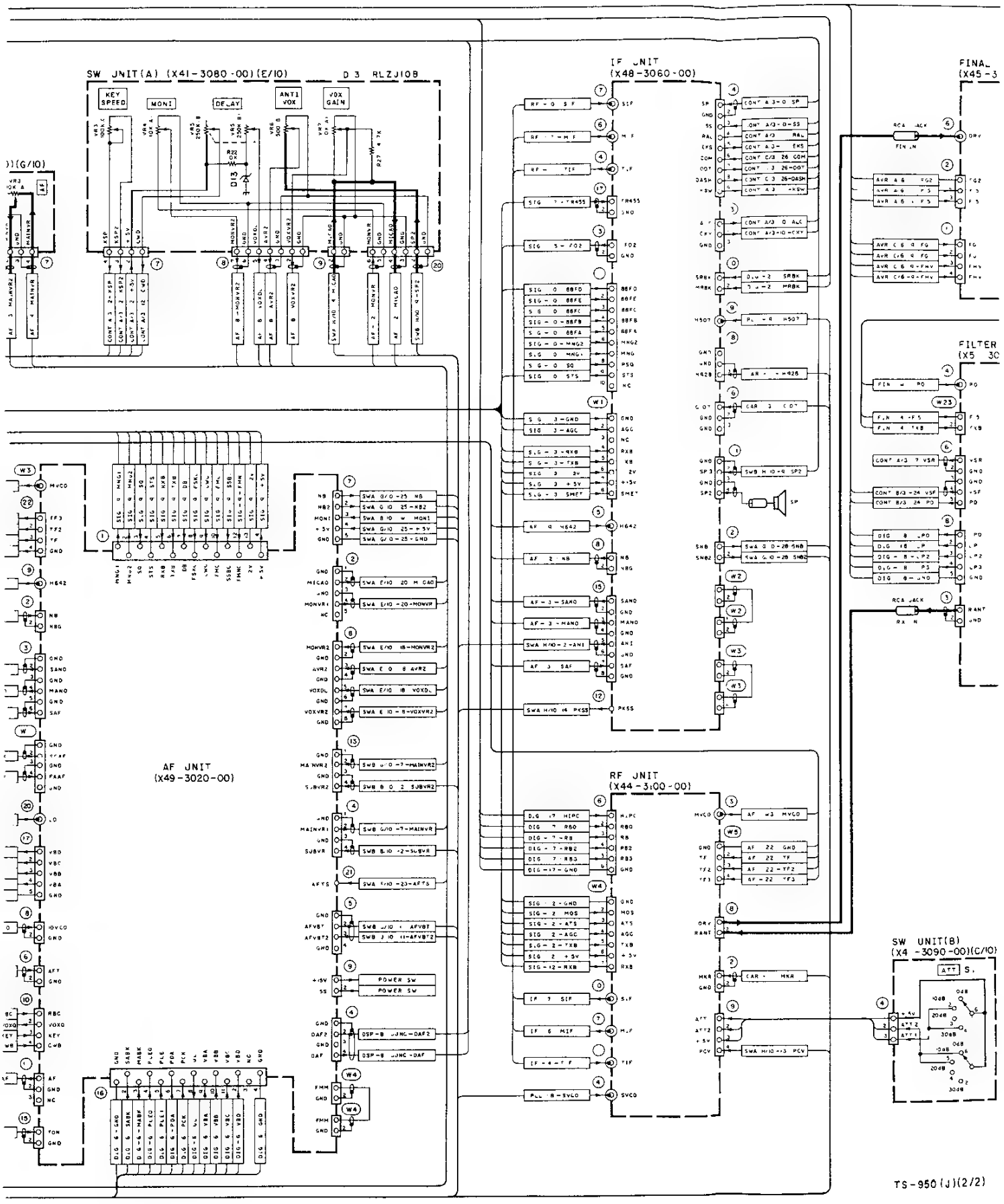
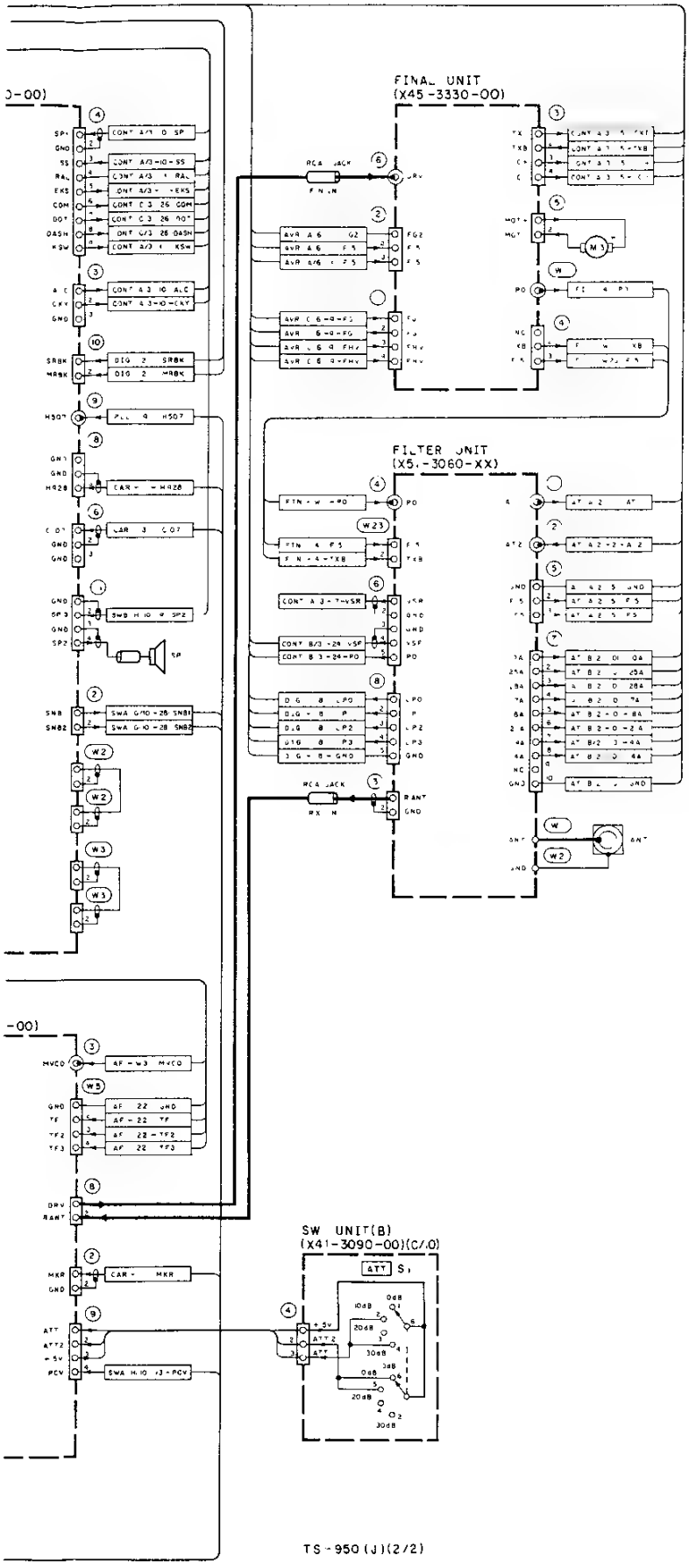

SW UNIT(A) (X41-3080-00)(E/10)
KEY SPEED
MONI
DELAY
ANTI VOX
VOX GAIN
IF UNIT (X48-3060-00)
RF UNIT (X44-3100-00)
AF UNIT (X49-3020-00)
SW UNIT(B) (X4 -3090-00)(C/10)
FILTER (X5 30
FINAL (X45-3
POWER SW
POWER SW
TS-950(J)(2/2)



TS-950(J)(2/2)

TS-950S/SD PC BOARD VIEWS

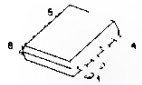
2SA1162
2SC2712
2SC2714
2SC3324
DTA114EK
DTA144EK
DTC114EK
DTC114TK
DTC144EK

2SK210

2SK508NV

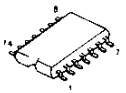
2SA1204

NJM2904M

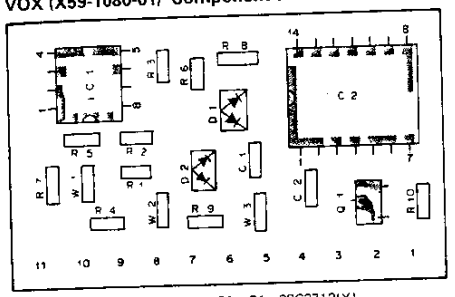


NJM4558M

TC4001BF
TC4011BF
TC4013BF

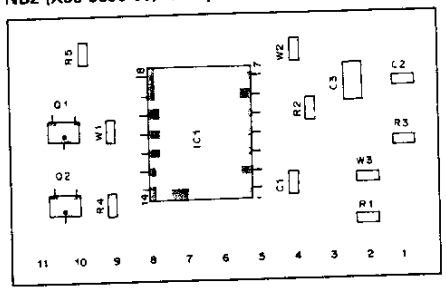


VOX (X59-1080-01) Component side view



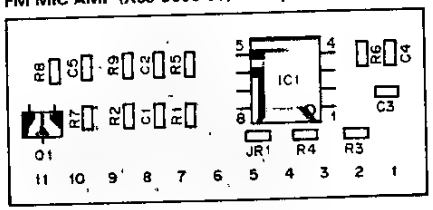
IC1 NJM2904M IC2 TC4001BF Q1 2SC2712(Y)
D1 2 DAP202(K)

NB2 (X59-3350-00) Component side view



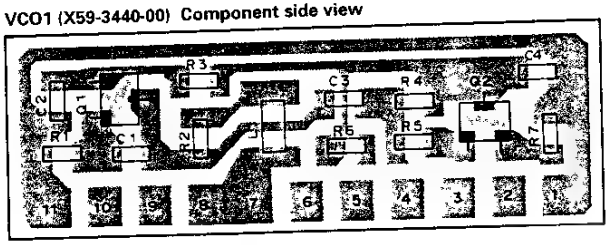
IC1 TC4011BF Q1,2 DTC114EK

FM MIC AMP (X59-3000-03) Component side view



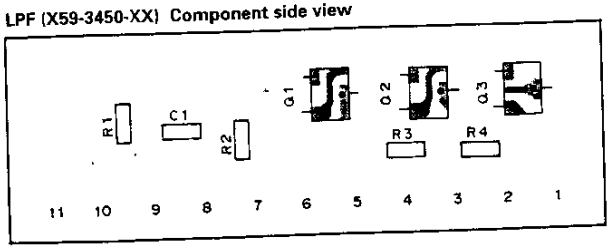
IC1 NJM4558M Q1 2SC2712(Y)

VCO1 (X59-3440-00) Component side view



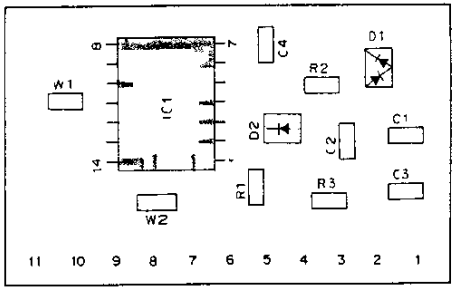
Q1 2SK210(GR) Q2 2SC2714(Y)

LPF (X59-3450-XX) Component side view



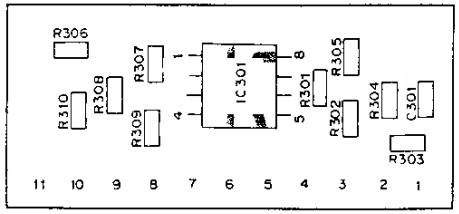
Q1- 3 2SC3324(G)

MKR (X59-3640-00) Component side view



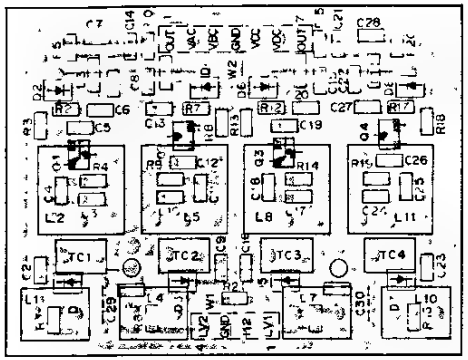
IC1 TC4013BF D1 DA204K D2 RLS73

MAP (X59-3670-00) Component side view

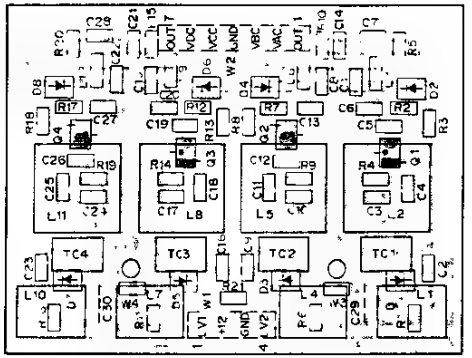


IC301 NJM4558M

VCO (X58-3630-XX) Component side view

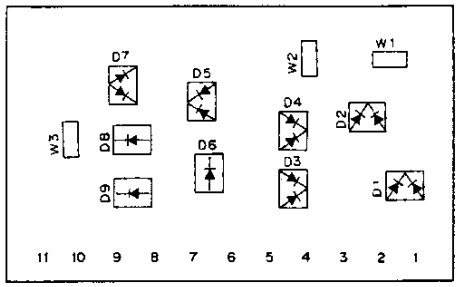


VCO (X58-3630-XX) Foil side view



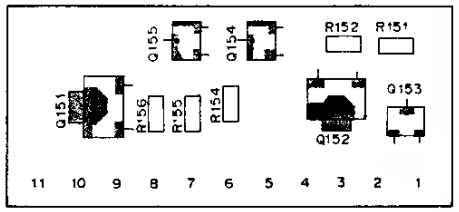
Q1–4 2SK210(GR) D1, 3 5 7 1SV166 D2, 4 6 8 RLS136

SFT (X59-3650-00) Component side view



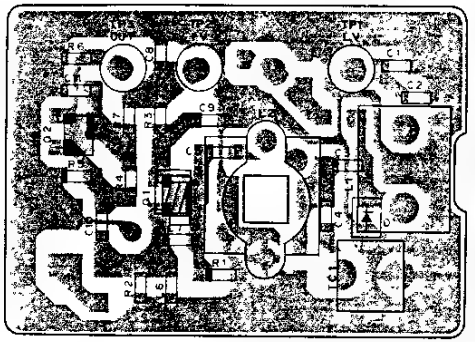
D1 5 DAN202(K) D6, 8 9 RLS73 D7 DAP202(K)

TRX (X59-3680-00) Component side view

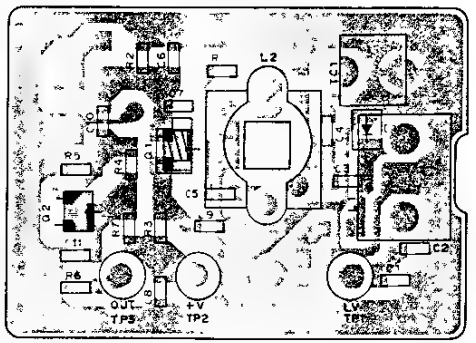


Q151 152 2SA1204(Y) Q153–155 DTC114TK

VCO2 (X59-3390-03) Component side view

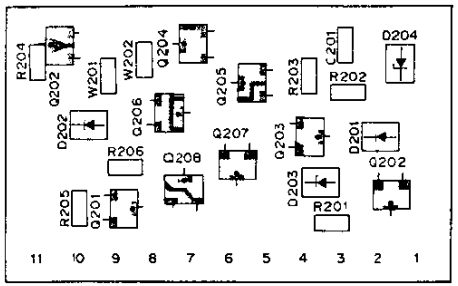


VCO2 (X58-3390-03) Foil side view



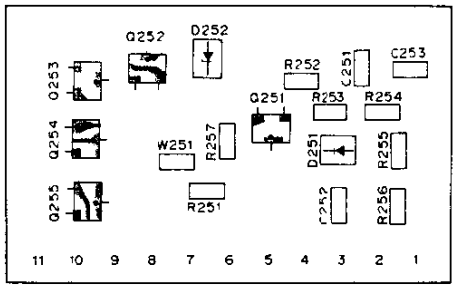
Q1 2SK508NV(K52) Q2 2SC2714(Y) D1 1SV164

CWT (X59 3660 00) Component isde view



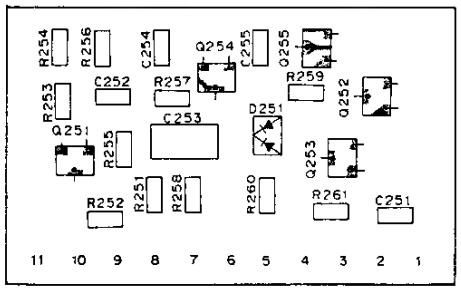
Q201 2SA1162(Y) Q202 205 207 DTA144EK
Q203, 204, 206 DTC144EK Q208 DTC114TK
D201 202 RLS73 D203 RLZJ3 6B D204 RLZJ4 7B

ALC (X59-3700-00) Component side view



Q251 2SC2712(Y) Q252 254, 255 DTC144EK Q253 DTA144EK
D251 RLS73 D252 RLZ12B

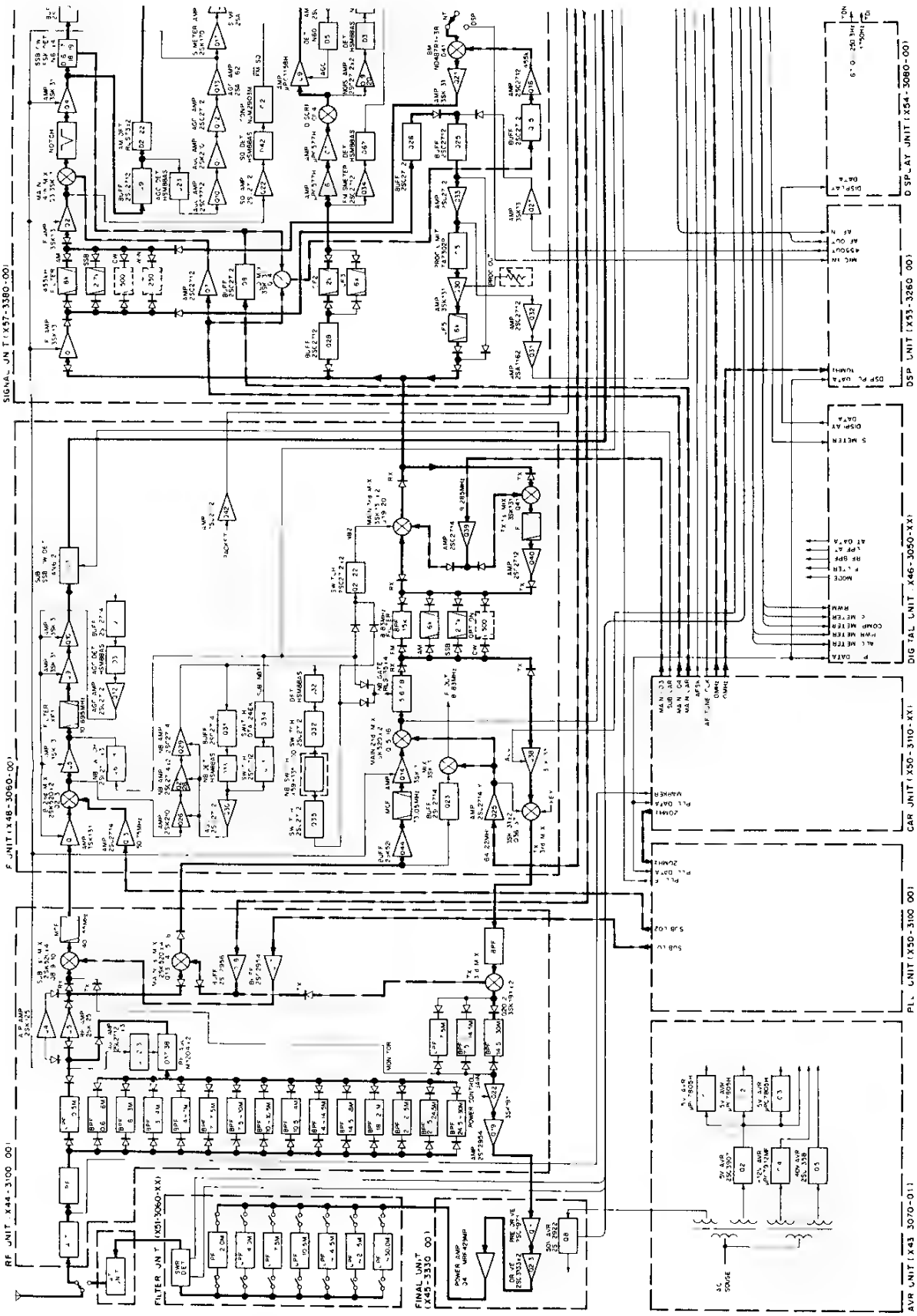
MIC AMP (X59-3710-00) Component side view



Q251 2SC3324(G) Q252, 253 DTA114EK Q254 DTC114TK
Q255 DTC114EK D251 DAN202(K)

IS-950S/SD IS-950S/SD

BLOCK DIAGRAM



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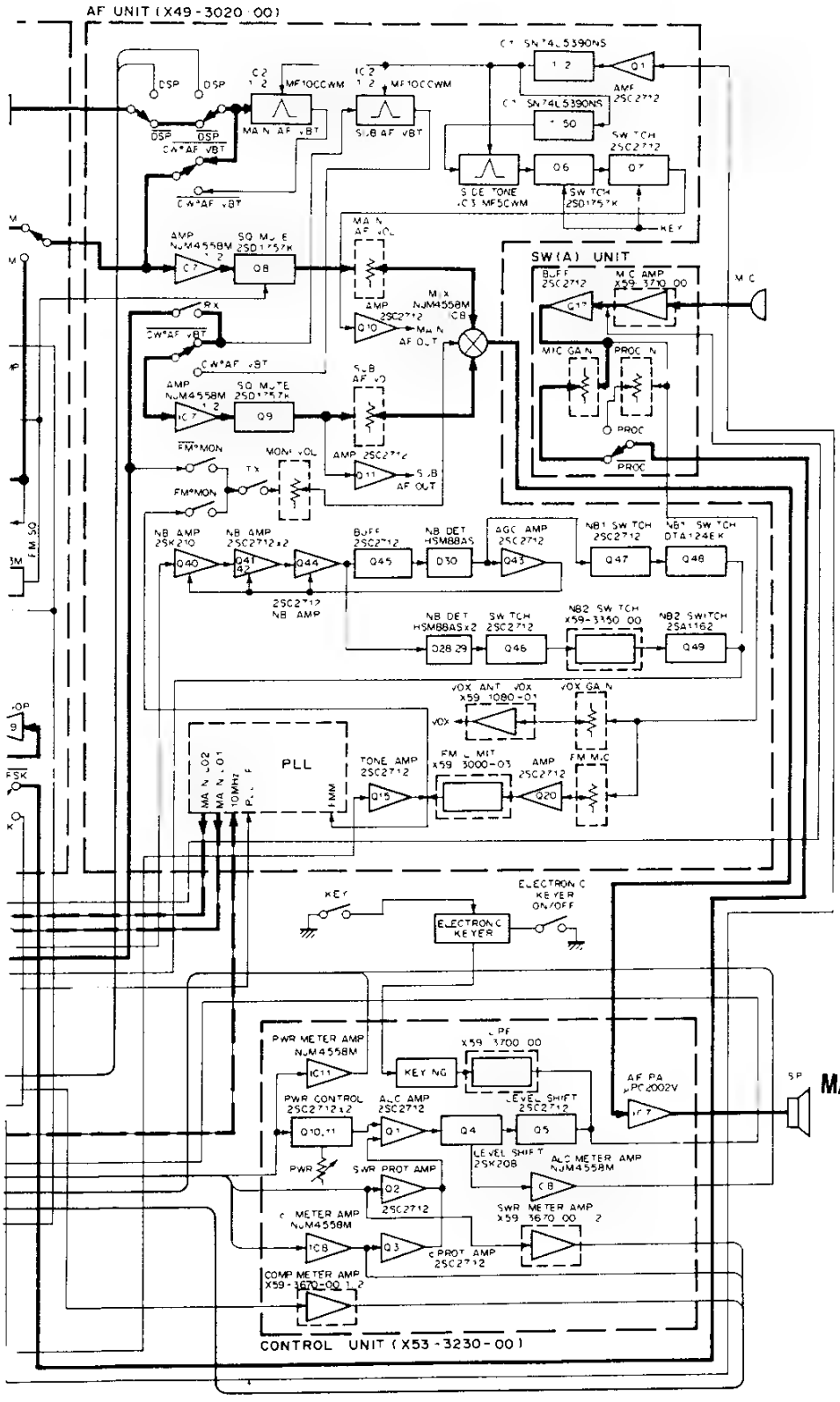
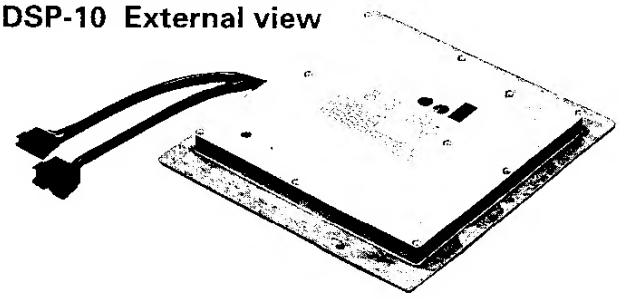


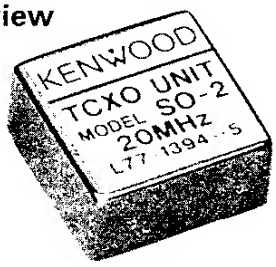
TS-950S/SD

DSP-10 (DIGITAL SIGNAL PROCESSOR) / SO-2 (TCXO UNIT) / YG-455S-1 (SSB FILTER)

DSP-10 External view



SO-2 External view



DSP-10 Speficications

Dimensions (W x D x H) ..... 220 x 200 x 28 (mm)
..... 8-21/32" x 7-7/8" x 1-3/32"
Weight ..... 1 kg (2.2 lbs)

SO-2 Specifications

Oscillating frequency ..... 20 MHz
Temperature stability ..... $\pm 5 \times 10^{-7}$ (–10°C to +50°C)
Frequency stability (Long term) ..... $\pm 1 \times 10^{-6}$/year
Output ..... 1 V peak-to-peak (20 kΩ/5 pF)

DSP-10 Parts list

Ref. No.	New	Parts No.	Description
	*	B40-7612-04	Model name plate
		B42-3343-04	Serial label
	*	B50-8352-00	Instruction manual
	*	H01-8297-04	Item carton box
	*	H12-1420-03	Packing fixture
		H25-0029-04	Protection bag
		N89-3008-45	Binding head taptite screw
	*	X53-3260-00	DSP unit

SO-2 Parts list

Ref. No.	New	Parts No.	Description
	*	B50-8314-08	Instruction manual
		L77-1394-15	TCXO

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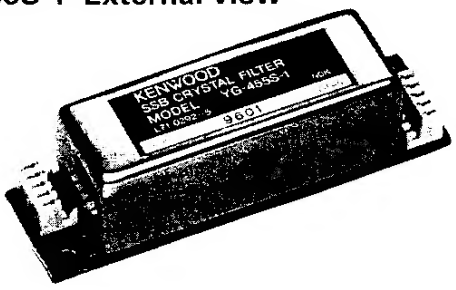
YG-455S-1 External view



TG-455S-1 Specifications

Center frequency ..... 455.0 kHz
Pass band width ..... 2.4 kHz (–6dB)
Attenuation band width ..... 4.1 kHz (–60dB)

SP-950 (EXTERNAL SPEAKER)

SP-950 External view

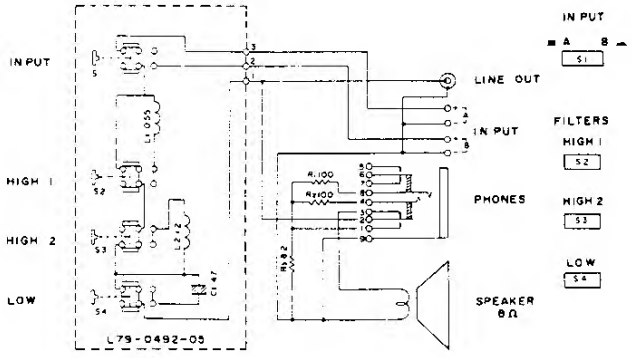
SP-950 Specifications

Speaker used ..... 10 cm dia.
Rated input ..... 1 W
Impedance ..... 8 Ω
Frequency response ..... 160 Hz to 7 kHz
Filter cut-off frequency
HIGH1 ..... 3.0 kHz/–3dB
HIGH2 ..... 1.2 kHz/–3dB
HIGH1, 2 ..... 900 Hz/–3dB
LOW 400 Hz/–3dB
Filter attenuation ..... –6dB/oct.
Dimensions (W x H x D) ..... 180 x 141 x 310 (mm)
Wight ..... 2.0 kg

SP-950 Parts list

Ref. No.	New	Parts No.	Description
		A01-1052-02	Metallic cabinet (Bottom)
	*	A01-1077-02	Metallic cabinet (Top)
	*	A20-7023-03	Panel
	*	A23-1517-03	Rear panel
		B04-0404-03	Speaker grill
	*	B40-3948-04	Model name plate
		B43-1098-04	Badge
	*	B50-8301-00	Instruction manual
		E30-1711-15	Speaker cord (Accessory)
		G10-0662-04	Non-woven fabric
	*	H01-8265-04	Item carton box
	*	H10-2668-02	Polystyrene foamed fixture
		H20-1433-03	Protection cover
		H25-0705-04	Protection bag
		J02-0049-14	Foot (Rear)
		J02-0423-04	Foot (Front outside)
		J02-0424-04	Foot (Front inside)
		J19-1325-04	Mounting hardware (Panel)
		J61-0307-05	Wire band
	*	K29-4519-04	Knob
		N33-3006-41	Flat head machine screw (Case)
		N87-3006-41	Brazier head taptite screw
		N87-4008-41	Brazier head taptite screw (Foot, SP)
		T07-0222-15	Speaker
		X41-3060-00	Switch unit

SP-950 Schematic diagram



SPECIFICATIONS

Specifications \ Model					TS-950S	TS-950S DIGITAL
General	Mode				J3E (LSB, USB), A1A (CW), A3E (AM), F3E (FM), F1A (FSK)	
	Memory channels				100	
	Antenna impedance				50Ω With Antenna Tuner 20 to 150Ω	
	Power requirement		K and P type		120V AC ± 10%	
			M type		120/220V AC ± 10%	
			W type		220/240V AC ± 10%	
			X type		120/240V AC ± 10%	
	Power dissipation		Receive mode with no input signal		110W	
			Transmit mode		700W (7.5A)	
	Operating temperature				–10 to +50°C (+14 to +122°F)	
	Frequency stability				Less than ±10 PPM	Less than ±0.5 PPM
	Frequency accuracy				Less than ±10 PPM	Less than ±0.5 PPM
	Dimensions (W x H X D) (Projections included)				409 x 154 x 446 mm (16-3/22" x 6-1/16" x 17-9/16")	
	Weight				23 kg (50.6 lbs)	
Transmitter	Frequency range		160m band		1.800 to 2.000MHz	
			80m band		3.500 to 4.000MHz	
			40m band		7.000 to 7.300MHz	
			30m band		10.100 to 10.150MHz	
			20m band		14.000 to 14.350MHz	
			17m band		18.068 to 18.168MHz	
			15m band		21.000 to 21.450MHz	
			12m band		24.890 to 24.990MHz	
			10m band		28.000 to 29.700MHz	
	Output power	1.9 to 24MHz	SSB, CW, FSK, FM	MAX	150W	
				MIN	20W	
			AM	MAX	40W	
				MIN	10W	
		28MHz	SSB, CW, FSK, FM	MAX	110W	
				MIN	20W	
			AM	MAX	40W	
				MIN	10W	
	Modulation		SSB		Balanced modulation	
			FM		Reactance modulation	
			AM		Low level modulation	
	Spurious radiation				Less than –40dB	
	Carrier suppression (with 1.5kHz reference)				More than 40dB	More than 50dB
	Unwanted sideband suppression (with 1.5kHz reference)				More than 50dB	More than 60dB
	Maximum frequency deviation (FM)				Less than ±5kHz	
	Frequency response (–6dB)				400 to 2600Hz	200 to 3100Hz
	XIT variable range				±9.99kHz	
	Microphone impedance				500Ω to 50kΩ	

SPECIFICATIONS

Specifications \ Model				TS-950S	TS-950S DIGITAL
Receiver	Circuitry	Main	SSB, CW, FSK, AM	Quadruple conversion superheterodyne	
			FM	Triple conversion superheterodyne	
		Sub	SSB, CW, FSK	Double conversion superheterodyne	
	Frequency range			100kHz to 30MHz	
	Intermediate frequency		Main	1st : 73.05MHz, 2nd : 8.83MHz 3rd : 455kHz, 4th : 100kHz	
			Sub	1st : 40.055MHz, 2nd : 10.695MHz	
	Sensitivity	SSB, CW (at 10dB S + N/N)	100kHz to 150kHz	Less than 2.5μV	
			150kHz to 500kHz	Less than 1μV	
			500kHz to 1.62MHz	Less than 4μV	
			1.62MHz to 30MHz	Less than 0.2μV	
		AM (at 10dB S + N/N)	100kHz to 150kHz	Less than 25μV	
			150kHz to 500kHz	Less than 10μV	
			500kHz to 1.62MHz	Less than 32μV	
			1.62MHz to 30MHz	Less than 2.0μV	
		FM (at 12dB SINAD)	28MHz to 30MHz	Less than 0.5μV	
	Selectivity		SSB, AM (N), FSK	–6dB : 2.4kHz, –60dB : 3.8kHz	
			AM (W)	–6dB : 6kHz, –50dB : 15kHz	
			CW (N)	–	–6dB : 250kHz, –60dB : 550kHz
			CW (W)	–6dB : 2.4kHz, –60dB : 3.8kHz	–6dB : 400kHz, –60dB : 900kHz
			FM	–6dB : 12kHz, –60dB : 24kHz	
	Image ratio			More than 80dB	
	1st IF rejection			More than 70dB	
	Notch filter rejection			More than 45dB	
	RIT variable range			±9.99kHz	
	Squelch sensitivity	SSB, CW, FSK, AM	100kHz to 150kHz	Less than 6.3μV	
			150kHz to 500kHz	Less than 2.5μV	
			500kHz to 1.62MHz	Less than 10μV	
			1.62MHz to 30MHz	Less than 0.5μV	
		FM	28MHz to 30MHz	Less than 0.32μV	
	Output			1.5W across 8Ω load (10% distortion)	
	Output load impedance			8Ω	

Notes
1. Circuit and ratings are subjest to change without notice due to advancements in technology.
2. Remember to keep the transmitting output power within the power limitations of your license.